



Proposed Plan of Action

Highway 71/72 Refinery Site

Bossier City, Louisiana

May 12, 2000

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
SUPERFUND DIVISION

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Acronyms

ARAR Applicable or Relevant and Appropriate Requirement

ATSDR Agency For Toxic Substances And Disease Registry

BAP Benzo(a)pyrene

BDAT Best Demonstrated Available Technology

BTEX Benzene, Toluene, Ethylbenzene, and Xylenes

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

CFR Code of Federal Regulations

CTE Central Tendency Exposure

EPA U. S. Environmental Protection Agency

FS Feasibility Study

HI Hazard Index

HQ Hazard Quotient

LDEQ Louisiana Department of Environmental Quality

LDNR Louisiana Department of Natural Resources

LDR Land Disposal Restriction

LNAPL Light Non-Aqueous Phase Liquids

LOPH Louisiana Office of Public Health

LPDES Louisiana Pollutant Discharge Elimination System

MCL Maximum Contaminant Level

MCLG Maximum Contaminant Level Goals

ND Not Detected

NPDES National Pollution Discharge Elimination System

PAH	Polynuclear Aromatic Hydrocarbon
RA	Remedial Action
RAO	Remedial Action Objective
RD	Remedial Design
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record Of Decision
SARA	Superfund Amendments and Reauthorization Act
Site	Highway 71/72 Refinery Superfund Site
SVOC	Semi-Volatile Organic Compound
VOC	Volatile Organic Compound

SECTION 1

Introduction and Community Participation

The U.S. Environmental Protection Agency (EPA) presents the following Proposed Plan for addressing hazardous substance contamination at the Highway 71/72 Refinery Site (Site) in Bossier City, Louisiana. The Site was proposed for placement on the Superfund National Priorities List (NPL), 40 Code of Federal Regulations (CFR) Part 300, Appendix B, on February 13, 1995. This proposal addresses the Site as a whole, and proposes the following actions:

- Dual phase (liquid and vapor) extraction of light non-aqueous phase liquids (LNAPL) associated with ground water
- Sampling for and removal of surface soils with concentrations of contaminants that exceed remediation goals in residential areas when requested by on-site community members
- Establishment of local capability to respond rapidly to future indoor air and contaminated soil concerns
- Establishment of local controls to prohibit use of contaminated ground water
- Periodic environmental monitoring of LNAPL, ground water, and indoor air to ensure protectiveness of the remedy

This document is issued by EPA, the lead agency for Site activity, with support from the Louisiana Department of Environmental Quality (LDEQ). Following public review and discussion of this Proposed Plan, EPA will make a final remedy selection that will be documented in the Record of Decision (ROD).

The purpose of the Proposed Plan is to fulfill statutory requirements pursuant to Sections 113(k)(2)(B), 117(a), and 121(f)(1)(G) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund), 42 U.S.C. §§ 9613(k)(2)(B), 9617(a), and 9621(f)(1)(G). It also describes the alternatives analyzed, identifies the preferred alternative, and solicits public involvement in the selection of a remedy.

This Proposed Plan has been developed by EPA. In developing this Proposed Plan, EPA consulted with Federal and state agencies including: the United States Department of the Interior (DOI), United States Fish and Wildlife Service (USF&W), National Oceanic and Atmospheric Administration (NOAA), Agency for Toxic Substance and Disease Registry (ATSDR), Louisiana Office of Public Health (LOPH), and LDEQ.

Community interest at the Site has been high. The EPA has held open houses and informal meetings with community leaders and area residents to seek input. A Community Relations Plan has also been developed by EPA with the help of the area residents.

The Proposed Plan highlights key information from the Remedial Investigation (RI) and Feasibility Study (FS) reports for the Site, but it is not a substitute for these reports. The results of the sampling activities and an assessment of the potential Site risks are presented in the RI Report. The development and evaluation of remedial alternatives to address the contamination are presented in the revised FS Report. For a complete source of information, please refer to these reports which are in the Administrative Record File located at the repositories listed below. The EPA encourages the public to review these documents in order to gain a more comprehensive understanding of the Site, the Superfund activities that have been conducted there, and the various alternatives that have been developed and evaluated to address the contamination at the Site. The EPA also encourages the public to participate in the decision-making process for the Site by making comments on all aspects of the Administrative Record File including the RI/FS and the Proposed Plan. The Administrative Record File is available at the following information repositories:

Bossier City Library
2206 Beckett
Bossier City, Louisiana 71111
(318) 746-1693

Louisiana Department of Environmental Quality
7290 Bluebonnet
Baton Rouge, Louisiana 70809
(225) 865-0487

U.S. Environmental Protection Agency
12th Floor Library
1445 Ross Avenue
Dallas, Texas 75202-2733
(214) 665-6444

A public meeting will be held in early June. The public is invited to orally comment on this Proposed Plan during the public meeting. Final decisions regarding the remediation of the Site will only be made after public comments are considered. The official public comment period begins on May 12, 2000 and ends on June 12, 2000. During the public comment period, written comments may be submitted to:

Donn Walters
Community Relations Coordinator
EPA, Region 6 (6SF-PO)

1445 Ross Avenue
Dallas, Texas 75202-2733
(214) 665-6483 or toll free (800) 533-3508

For more information about the public involvement process or if you have questions about activities at the Site, please contact:

Kathleen Aisling
Remedial Project Manager
EPA, Region 6 (6SF-LT)
1445 Ross Avenue
Dallas, Texas 75202-2733
(214) 665-8509 or toll free (800) 533-3508

or

Charles Andrews
Environmental Quality Specialist
Louisiana Department of Environmental Quality
7290 Bluebonnet Road
Baton Rouge, Louisiana 70809
(225) 765-0487

SECTION 2

Site Background

Site Location and Physical Description

The Site (also called the Old Citgo Refinery, or the Arkansas Fuel Oil Refinery) is located near the intersections of Louisiana State Highways 71 and 72 in Bossier City, Bossier Parish, Louisiana (Figure 1). The Site is approximately 2 miles east of downtown Shreveport and 1,500 feet north of the Red River. The geodetic coordinates of the Site are 32 degrees 31 minutes north latitude and 93 degrees 42.7 minutes west longitude. The Site consists of approximately 215 acres of land where a crude oil refinery was once located. The refinery included processing areas, bulk storage areas, distribution areas, and a railroad tank car repair yard. At the time of operation, the refinery was north of the Kansas City Southern Railroad lines and south of the Illinois Central Gulf Railroad lines.

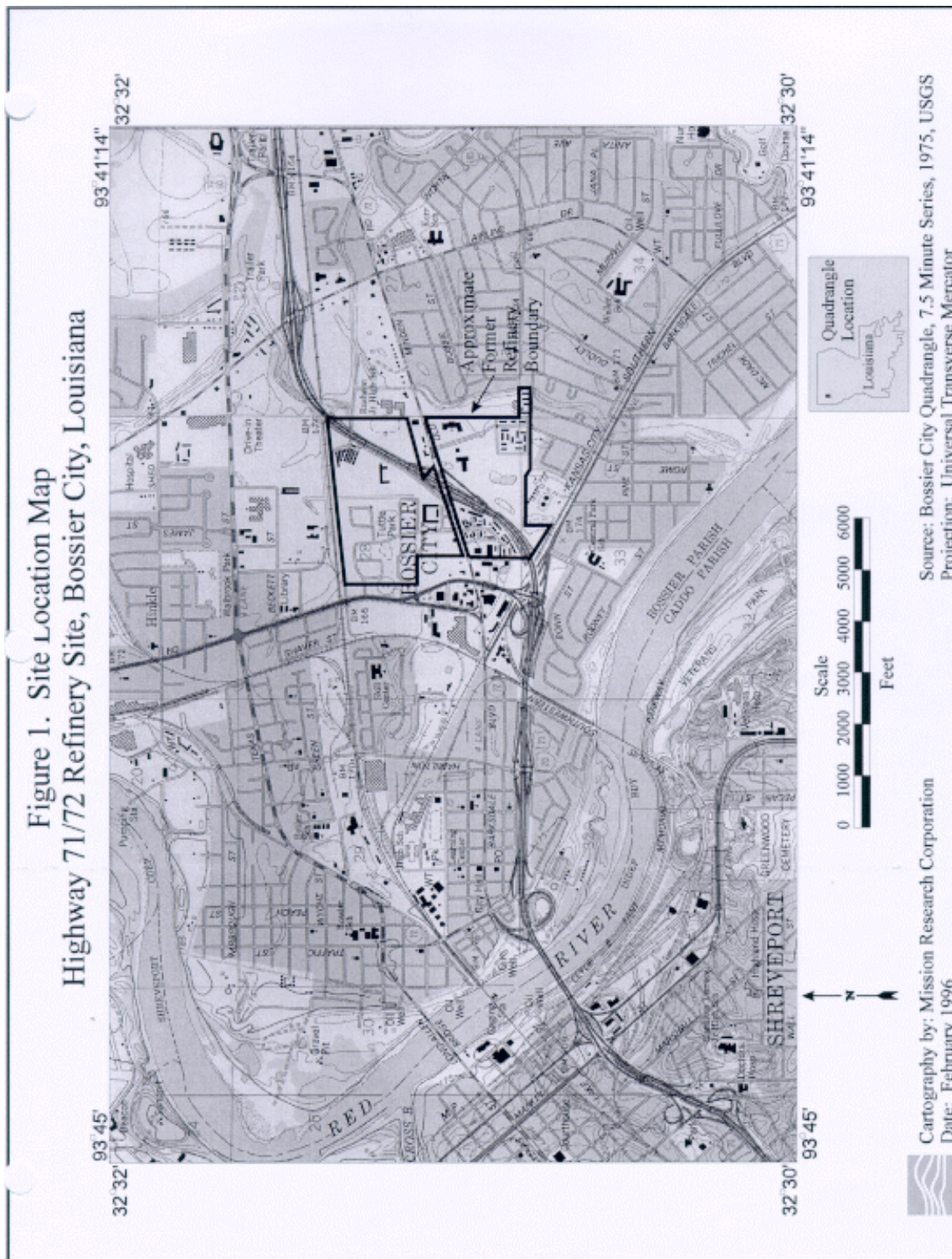
Today, the Site is fully developed with single-family homes, apartments, and businesses. There are approximately 3,500 people living within the former refinery boundaries, including approximately 370 children who are six years old and under (U.S. Census Bureau, 1998).

Site Operational History

This summary of Site operational history is based on an analysis of aerial photographs (EPA, 1985; Lockheed Environmental, 1995), the deposition of one former employee taken in 1995 (U.S. Department of Justice, 1995), information provided by OXY USA, Inc. (OXY) in response to an EPA CERCLA Section 104(e) Information Request Letter (OXY USA, 1995), and on an investigation of the ownership history of the Site (TechLaw, 1998). A detailed review of Site operational history and Site ownership is found in the Site RI Report (Mission Research Corporation, 1999).

Between 1923 and 1929, the Louisiana Oil Refining Corporation (LORECO) acquired the property now known as the Site (except for a small part) (TechLaw, 1998) and began building a refinery for the production of home heating and fuel oil (C-K Associates, 1988). LORECO continued to operate the Site until about 1938 when Arkansas Fuel Oil Company purchased the property.

In November 1938, the Louisiana Oil Refining Corporation sold all property that it owned within the Site to Arkansas Fuel Oil Company. By September 1940, Arkansas Fuel Oil Company had acquired ownership of all land within the Site boundary. Arkansas Fuel Oil



Company continued to operate the refinery until some time between 1944 and 1948 when the refining operations were shut down.

In 1953, Arkansas Fuel Oil Company merged with Arkansas Natural Gas Corporation, and the surviving corporation was named Arkansas Fuel Oil Corporation which became the owner of the Site, except for one tract that Arkansas Fuel Oil company sold in 1951. In October 1957, Arkansas Fuel Oil Corporation conveyed a tract of land to the Bossier Parish School Board.

In December 1960, Arkansas Fuel Oil Corporation conveyed and assigned all but one tract of its property within the former refinery boundaries to Cities Service Reserves, Inc. The property was then conveyed to Cities Service Company (CSC). In 1962 and 1963, CSC conveyed several tracts of Site land. In 1964, the State of Louisiana, through the Department of Highways, expropriated two tracts of Site land for the Interstate 20 right-of-way.

In 1961, Cities Service Oil Company and Orange State Oil Company merged into Arkansas Fuel Oil Corporation, which simultaneously changed its corporate name to Cities Service Oil Company. In 1962, Cities Service Oil Company and Cities Service Refining Corporation merged with Cities Service Petroleum Company and the surviving corporation was named Cities Service Oil Company.

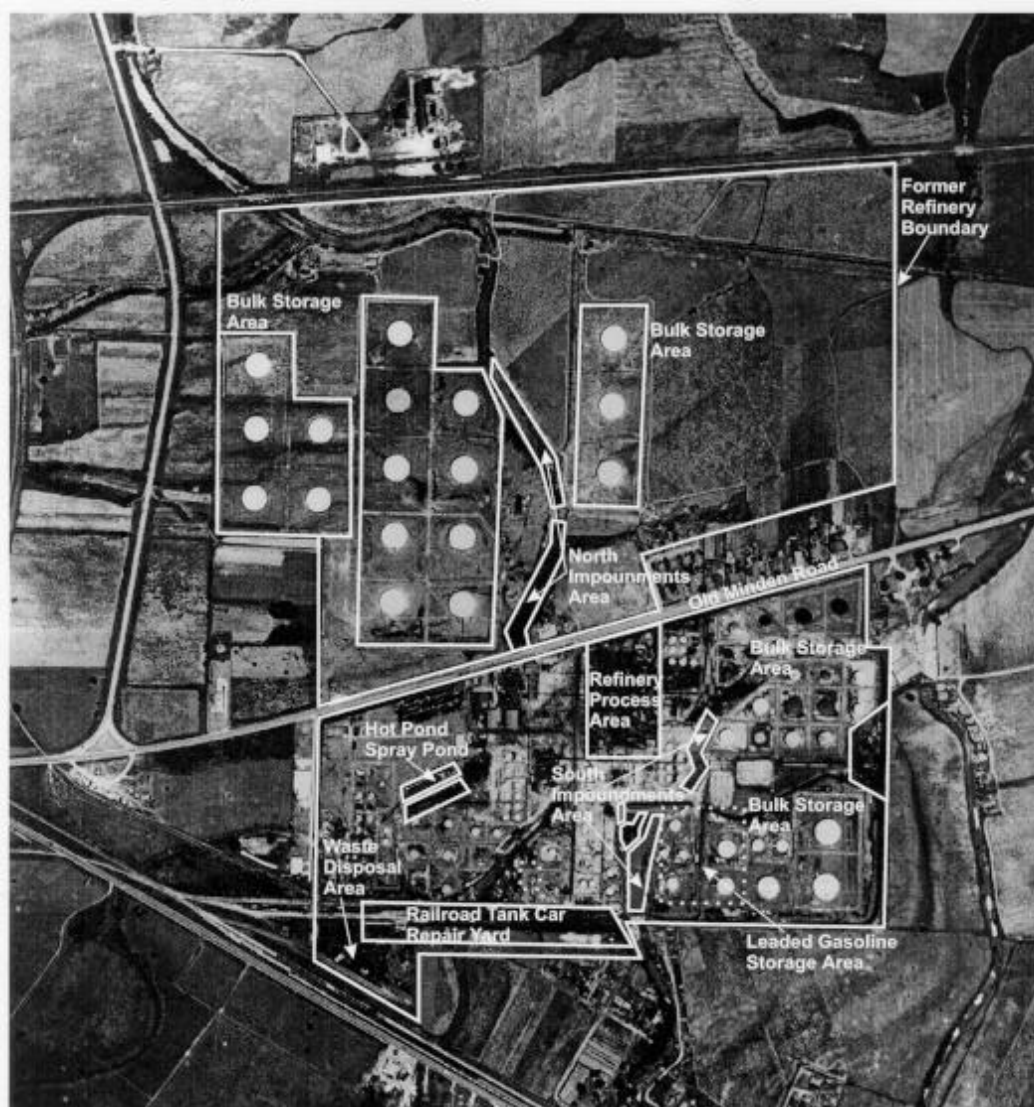
In August 1965, Cities Service Company and Cities Service Oil Company conveyed one tract of Site land to a railroad. By this time Cities Service Oil Company owned one tract of land within the former refinery boundaries while Cities Service Company owned the remainder of the property with the exception of the tracts that had been previously conveyed or expropriated. In September 1967, Cities Service Oil Company conveyed one tract of land to Cities Service Company. The Site continued to operate as a petroleum storage and distribution facility until about 1967 when the Site was cleared for redevelopment.

Throughout 1967, 1968, and 1969, Cities Service Company and Cities Service Oil Company conveyed various tracts of land to several parties. By December 1973, Cities Service Oil Company and Cities Service Company owned only two tracts and a portion of a third tract within the former refinery boundaries.

Figures 2, 3, and 4 are aerial photographs depicting Site conditions in 1939, 1955, and 1992, respectively. Significant former refinery features indicated on Figure 2 include the former refinery boundary, bulk storage areas, north and south impoundment areas, the refinery process area, leaded gasoline storage areas, hot pond/spray pond, waste disposal area, and the railroad tank car repair yard.

During operations, the Site consisted of a bulk storage area north of Old Minden Road (approximately 120 acres) and a refinery process, bulk storage, and distribution area

Figure 2. 1939 Refinery Features
Highway 71/72 Refinery Site, Bossier City, Louisiana



Scale
0 200 400 600 800
Feet



Cartography by: Mission Research Corporation
Date: July 1997

Source: EPA, 1995, Aerial Photographic Analysis of the Old Citgo Refinery, Bossier City, Louisiana. Environmental Monitoring Systems Laboratory, Las Vegas, NV.

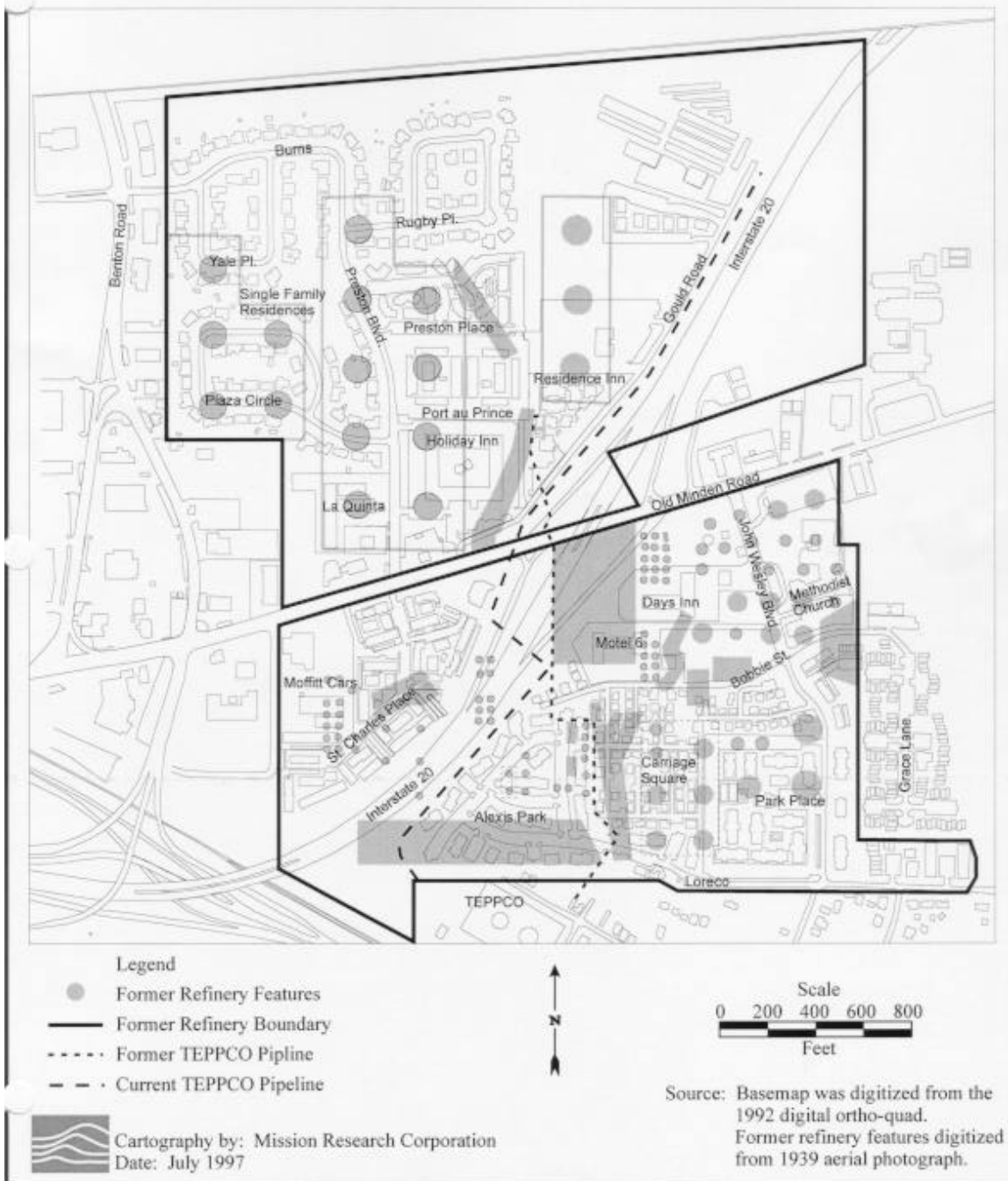
Figure 3. 1955 Dismantling of the Refinery
Highway 71/72 Refinery Site, Bossier City, Louisiana



Cartography by: Mission Research Corporation
Date: May 1998

Source: EPA, 1995, Aerial Photographic Analysis
of the Old Citgo Refinery, Bossier City,
Louisiana. Environmental Monitoring
Systems Laboratory, Las Vegas, NV.

Figure 4. Current Land Use and Former Refinery Features of the Highway 71/72 Refinery Site, Bossier City, Louisiana



(approximately 90 acres) located south of Old Minden Road. Crude oil was stored in steel storage tanks on the northern half of the Site. Steel tanks on the southern half of the Site were used to store refined products such as leaded gasoline, no weed oil, and kerosene. Many of the steel storage tanks were surrounded by earthen berms, also called dikes. In addition, tetraethyl lead, a gasoline additive, was stored on the southern half of the Site. The refinery process area consisted of catalytic cracking units, warehouses, and other support buildings (EPA, 1985; Lockheed Environmental, 1995). Railroad tank cars were cleaned and repaired on the southern portion of the Site. A gasoline loading rack, fuel oil loading racks and truck loading racks were also located near the southern boundary of the Site.

The refinery waste disposal and drainage system consisted of a series of open ditches directed to impounded bayous that flowed by gravity to an oil/water/solids separator before wastewater was discharged to another impounded bayou. The impoundments were used for process wastewater, oily cooling wastewater, storm water runoff, water from storage tank draining and cleaning operations, and non-contained spills. The impoundments received dry weather flow of oily cooling wastewater and process wastewater. The impoundments were also used for the disposal of sludge generated during treatment or storage of this wastewater. The north impoundment area included the main oil trap (OXY USA, 1995, Meyer, 1997).

Other elements of the waste disposal system included the south impoundment area, the hot pond/spray pond, sumps in the railroad tank car repair yard, and the waste disposal area. In addition to the north and south impoundments, other areas of the Site received dry weather flow of oily cooling wastewater and process wastewater, including the waste disposal area in the southwest corner and the hot pond/spray pond area. These areas were also used for the treatment and storage of oily cooling wastewater and process wastewater.

Process wastewaters disposed of at the Site included condensate from steam-stripping operations, tank emulsions and water draw-offs, and other wastewaters containing emulsions, heavy oils, or tar. Oily cooling wastewaters include uncontrolled oily storm water from refinery processing and tankage areas, and controlled oily storm water released from diked areas or surge ponds. The deposition of a former employee indicates that condensate from steam stripping operations was produced when the railroad tank cars were steam-stripped prior to repair. The deposition also indicates that water was drawn from tank bottoms and spilled onto the Site (U.S. Department of Justice, 1995). These process wastewaters were disposed of on-site in various impoundments, and sludges from these process wastewaters were also disposed of in on-site impoundments. That is, at the point where the process wastewaters were disposed of and contained in an impoundment, lateral particle movement ceased, and a sludge was formed, and this sludge was also disposed of in these impoundments.

The refinery was operational until shortly after the end of World War II. The refinery was shut down some time between 1944 and 1948 (OXY USA, 1995). By 1955, the refinery process area was dismantled (Lockheed Environmental, 1995). The former refinery site continued to serve as a petroleum storage and distribution facility even after refinery operations were discontinued. Petroleum stored at the Site included leaded gasoline. By 1955, a significant portion of the refinery process equipment had been dismantled (Lockheed, 1995), and most of the tanks and bulk storage were leased to third parties (OXY USA, 1995). Between 1955 and 1967, various refinery operations were removed and sold. By 1966, an interstate highway corridor (I-20) was under construction through the Site. The interstate highway was completed by the late 1960's (Lockheed Environmental, 1995).

In November 1966, CSC announced plans for the demolition of the remaining refinery structures and cleanup of the property. A land use plan was subsequently approved by the Bossier City Council and the Bossier City-Parish Metropolitan Planning Commission. Newspaper accounts indicate that the announcement by CSC and the local developer were favorably received by Bossier City officials (C-K Associates, 1988). In 1966 and 1967, CSC undertook site clearing, which is reported to have included: filling in all remaining ponds and bayous (with soil) with the exception of the two canals on the north half of the property; leveling all dikes, spoils banks, and mounds; clearing structures, foundations, and piping in planned residential areas to a depth of two feet; removing oil, product, and gas lines regardless of depth, and burning or removing all asphaltic refinery waste from the Site.

Recent investigations and response actions conducted at the Site found evidence that shows the Site was not thoroughly cleaned in the 1960's as had been reported. (See Previous Response Action Section of this Proposed Plan; and see the photos from the October 1999 water main break at the Site, Bossier City Fire Department, 1999.) During the investigations and response actions, it became apparent that, during the 1960's, sludge deposits were buried under thin layers of fill material or simply graded into a level surface without any attempt at removal. High concentrations of lead (greater than 40,000 parts per million [ppm]) found in surface soil and subsequently addressed through a removal action (see Previous Response Action Section of this Proposed Plan) indicate lead contamination was present at the time the Site was cleared for development in the 1960's, and also indicate that lead contamination could still be present in the surface soil that has not been addressed by the removal action. In this Proposed Plan, "shallow surface soil" means soil in the top two inches below ground surface (bgs), "surface soil" means soil from 0 to 2 feet below ground surface (bgs), and "subsurface" or "deeper" soil means soil at depths greater than 2 feet bgs.

Numerous abandoned pipelines, foundation remnants, concrete rubble, railroad tracks and ties, coke material, and tar material (sludge) were also encountered in the surface soil during recent response actions conducted at the Site (Mission Research Corporation,

1999). These response actions are detailed in the Previous Response Action section of this Proposed Plan. In addition, when a buried water main ruptured near the Alexis Park Apartments, a layer of black hydrocarbon-stained soil was uncovered during the repair operation (Bossier City Fire Department, 1999). This material may be serving as a source of ground water or indoor air contamination. Information contained in the OXY response to EPA's information request also indicates that lead-contaminated sludge material was burned and buried on-site prior to redevelopment (OXY USA, 1995). In summary, physical evidence and documentary evidence has shown that significant quantities of refinery wastes are still present at the Site in surface and subsurface soils.

In 1978, Cities Service Oil Company merged into Cities Service Company. By July 1983, after several land conveyances, CSC owned only one tract of land within the former refinery boundary (TechLaw, 1998). In September 1983, Cities Service Company was renamed Cities Offshore Production Company and in February 1984, Cities Offshore Production Company changed its name to CanadianOxy Offshore Production Co. (COPCO) (U.S. EPA, 1996a). COPCO is the potentially responsible party (PRP) for the Highway 71/72 Refinery Site. Under CERCLA, PRPs are potentially responsible for the remediation of the site of a release of hazardous substances. Glenn Springs Holdings, Inc. (GSHI) is an indemnitor of COPCO. An indemnitor is a party who, through an agreement with a company, agrees to reimburse another party if the company with which it has the agreement becomes liable for an action covered under the agreement. OXY was another COPCO indemnitor.

Summary of Previous Investigations

Site investigations began in 1985 and were conducted primarily under the direction of CSC and later OXY. The LDEQ provided oversight of Site investigations prior to EPA's proposed listing of the Site on the National Priorities List (NPL) of Superfund Sites in 1995. The EPA has gathered additional site-specific sampling data during planning and implementation of response activities at the Site. This section briefly summarizes the scope of Site investigations.

From 1985 through 1987, five episodes of limited investigations were conducted on or adjacent to the Site. These investigations included limited sampling of hydrocarbon residue, coke material, and stained soil in the areas of the Bossier Crossroads Shopping Center, the old refinery process areas, the petroleum waste disposal area located in the southwest corner of the Site (based on aerial photographs), one Carriage Square residence, and the Alexis Park Apartment Complex (C-K Associates, 1988).

In August 1986, the Site was evaluated for EPA by its Field Investigation Team. Approximately 15 soil samples were collected from a maximum depth of 4 feet bgs. These samples were analyzed for both organic (contaminants like benzene commonly found in hydrocarbon-contaminated materials) and inorganic (metal) compounds. In this Proposed Plan the terms "hydrocarbon-contaminated" and "organic-contaminated" are used interchangeably to describe some of the Site material. The highest observed lead concentration at that time was 6,980 parts lead per million parts soil (ppm) (later sampling efforts found much higher lead concentrations). Using the Hazardous Ranking System (HRS) model in effect at the time, the Site scored below the 28.5 HRS score necessary to qualify for submittal as an NPL candidate (Ecology and Environment, 1986). Therefore, in February 1988, the Site was referred to LDEQ for action under state authority.

In 1990, a Site Investigation of the Alexis Park Apartment Complex was conducted by the OXY contractor, ERM-Southwest, Inc., to determine the source, and the lateral and vertical extent of the hydrocarbon vapors detected at the Site, and to better define the shallow stratigraphy. This investigation included the installation of 18 soil borings, and the implementation of a shallow soil-gas survey (ERM-Southwest, 1990a). ERM-Southwest, Inc. also conducted indoor air monitoring of apartment buildings in the complex because of odor complaints, and because LOPH ordered certain apartments on the Site to be evacuated because of the presence of vapors which could potentially become explosive (ERM-Southwest, 1990b). ERM-Southwest also conducted vapor sampling and a deep soil-gas survey at the Alexis Park Apartment complex to determine the generating source or sources of methane and other hydrocarbon vapors detected during previous investigations (ERM-Southwest, 1990c).

Under an Investigative Agreement between OXY and LDEQ, signed in August 1991, OXY had ERM-Southwest, Inc., prepare a work plan for a Site investigation intended to determine the nature and extent of contamination (ERM-Southwest, 1992). OXY's objective was to obtain sufficient, quality data to assess potential risks to human health and the environment attributable to previous refinery activities at the Site. The work was conducted from 1991 through 1994 and included investigations of subsurface soil, ground water, surface soil, and surface water. In 1994, ERM-Southwest, Inc. documented the findings of the investigation in a five-volume interim report submitted to LDEQ (ERM-Southwest, 1994).

In 1992, OXY contracted Exploration Technologies Inc., to conduct a soil vapor investigation throughout the former refinery area (Exploration Technologies, 1993). Based on the results of the soil vapor investigation, OXY contracted Law Environmental Inc. to conduct indoor air screening in those areas where elevated soil vapor readings were found (Law Environmental, 1993). In 1994, Law Environmental Inc., followed this investigation with indoor air monitoring in 36 on-site locations where indoor airborne hydrocarbons had been documented (Law Environmental, 1994).

In September 1992, EPA conducted an Expanded Site Investigation (ESI) to re-evaluate the Site using the revised HRS model (PRC Environmental Management, 1993). Under the revised HRS, the Site received a score of 50. A site must score 28.5 or higher to be listed on the NPL. On February 13, 1995, EPA proposed that the Site be placed on the NPL.

In 1994, Texas Eastern Petroleum Products Company (TEPPCO) completed an analysis of LNAPL in six wells located within the former refinery process area (Environmental Excellence Group, 1994).

In 1995, MRC collected two surface soil samples consisting predominately of tar and coke material. The sampling objective was to analyze the tarry and coke material for metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and full suite Toxicity Characteristic Leaching Procedure (TCLP) testing. One sample showed a lead concentration above 500 ppm (Mission Research Corporation, 1995). In 1995, OXY collected four surface soil samples from several Site locations. Analytical results indicated lead above 500 ppm in one sample (OXY USA, 1996).

Results of Public Health Assessment and Additional Studies

On June 4, 1996, LOPH and the Superfund Site Assessment Branch of the Division of Health Assessment and Consultation of the ATSDR released a draft Public Health Assessment for the Site (Louisiana Office of Public Health, 1996). The draft Public Health Assessment described the Site at that time as a public health hazard based on three findings: (1) lead concentrations reported in soil would pose a future health risk to young children if they frequently come in contact with the lead-contaminated soil; (2) benzene concentrations reported in indoor air (1990-1994) may pose a health threat if the short-term benzene measurements are representative of daily exposures; and (3) methane concentrations measured indoors and in soil gas may pose a potential explosion hazard.

LOPH and ATSDR stated, in their 1996 report, that in certain areas of the Site, shallow surface soil, 0 to 2 inches bgs (where there is the highest probability of exposure for children), was contaminated with lead. The areas of lead contamination with the highest lead concentrations had been covered with grass to reduce the likelihood that the residents would come in contact with the lead-contaminated soil. Young children (six months to six years) are the population most sensitive to lead exposure in soil and to the health effects of that exposure.

In July 1995, LOPH and ATSDR tested the blood of Site children whose parents came forward in response to Site-wide notices. The purpose of the testing was to determine whether children living on-site had elevated blood lead levels. Blood lead values were found to be in the normal range, below the levels requiring medical follow-up. Although

the blood lead levels of children tested in the exposure investigation were below levels requiring follow-up, LOPH was only able to get consent from parents to test 55 out of the approximately 370 children ages six months to six years who live on-site. The children tested may not have been representative of the larger population of children living on-site.

LOPH and ATSDR made several recommendations for the Site based on their 1995 findings. At that time LOPH and ATSDR said:

- Additional indoor air sampling should be conducted to include analysis for refinery related chemicals and sampling should be of more frequent and longer duration
- Contaminants in soil gas should be measured concurrently with indoor air contaminants
- Measures should be taken to limit exposure of small children to areas of lead-contaminated soil (Louisiana Office of Public Health, 1996)

In response to these recommendations, in June 1996, EPA conducted sampling of indoor air at 92 on-site locations, where access was granted, using the EPA Trace Atmospheric Gas Analyzer (TAGA). Additionally, Summa canister samples of indoor air were collected in 31 on-site location in order to determine time-weighted exposure to contaminants of concern (COCs) (Weston, 1996). Locations of Summa canisters were determined based on TAGA results.

On January 6, 1997, LOPH and ATSDR released a Health Consultation for the Site based on the results of EPA's June 1996 TAGA sampling of indoor air (Louisiana Office of Public Health, 1997). At that time, LOPH and ATSDR drew several conclusions:

- Indoor air concentrations of benzene in some on-site residences may pose an unacceptable cancer risk for long-term residents
- Some residential and motel units on the Site have consistently shown benzene levels above 10 parts per billion by volume (ppbv) during four sampling episodes spanning six years
- The source of benzene in indoor air on the Site in spaces tested could not be attributed solely to household products
- Indoor air concentration levels of contaminants other than benzene were below levels associated with detrimental health effects

LOPH and ATSDR recommended that:

- Site residents and property owners should be made aware of the health risks

- Exposure of Site residents and motel patrons to benzene levels of health concern should be mitigated
- On-site soil gas and indoor air sampling should be expanded (Louisiana Office of Public Health, 1997)

A final Public Health Assessment has not yet been issued for the Site.

Previous Response Actions

Both OXY and GSHI have performed, on behalf of the PRP COPCO, removal actions under EPA orders at the Site. "Removal actions" are defined broadly and include a wide range of actions taken to study, clean up, prevent or otherwise address releases and threatened releases at a site. "Remedial actions," which include the actions which will be taken when the ROD is finalized for the Site, are those actions consistent with permanent remedies, taken instead of, or in addition to, removal actions.

On July 31, 1996, EPA ordered COPCO to conduct a removal action to address lead-contaminated surface soils. Under the order, lead-contaminated surface soil characterization, excavation and off-site disposal were conducted initially by OXY and then by GSHI, both on COPCO's behalf (Conestoga-Rovers & Associates, 1998a). For removal actions, EPA uses the term "action level" to mean the contaminant concentration level at which the response action in question will be taken. Action levels should not be confused with "cleanup levels." The cleanup level is the contaminant concentration level which the response action is designed to meet. That is, once EPA has identified a contaminated medium (in this case soil) which contains concentrations of a contaminant (in this case lead) which exceed the action level, the removal action calls for continued response (in this case excavation to a maximum depth of two feet bgs) until the concentration of the contaminants in the contaminated medium are below the established cleanup levels. For the Soil Removal Action that EPA ordered in 1996, the action level for lead was 500 ppm, and the cleanup level was also 500 ppm.

The Soil Removal Action included an investigation of 13 areas to determine the extent of soil lead contamination in those areas. A 500 ppm action level and cleanup level was selected for the removal action based on experience at other Region 6 Superfund Sites including the RSR Corporation Site in Dallas, Texas. In addition to the areas that were to be investigated and addressed if necessary, three Site areas where lead concentrations were known to exceed action and cleanup levels were targeted for response action under the Soil Lead Removal. From 1996 up to June 1998, approximately 6,630 cubic yards of lead-contaminated soil were removed from the Site and disposed of off-site at an approved landfill (Conestoga-Rovers, 1998a). In June 1998, an additional 1,228 cubic yards of lead-contaminated surface soil was excavated and disposed of off-site. The Lead Removal

Action was officially completed on December 30, 1998. Figure 5 shows the approximate boundaries of the surface soil areas that were addressed during the Lead Removal Action. More detailed descriptions of the Lead Removal Action are included in the RI report.

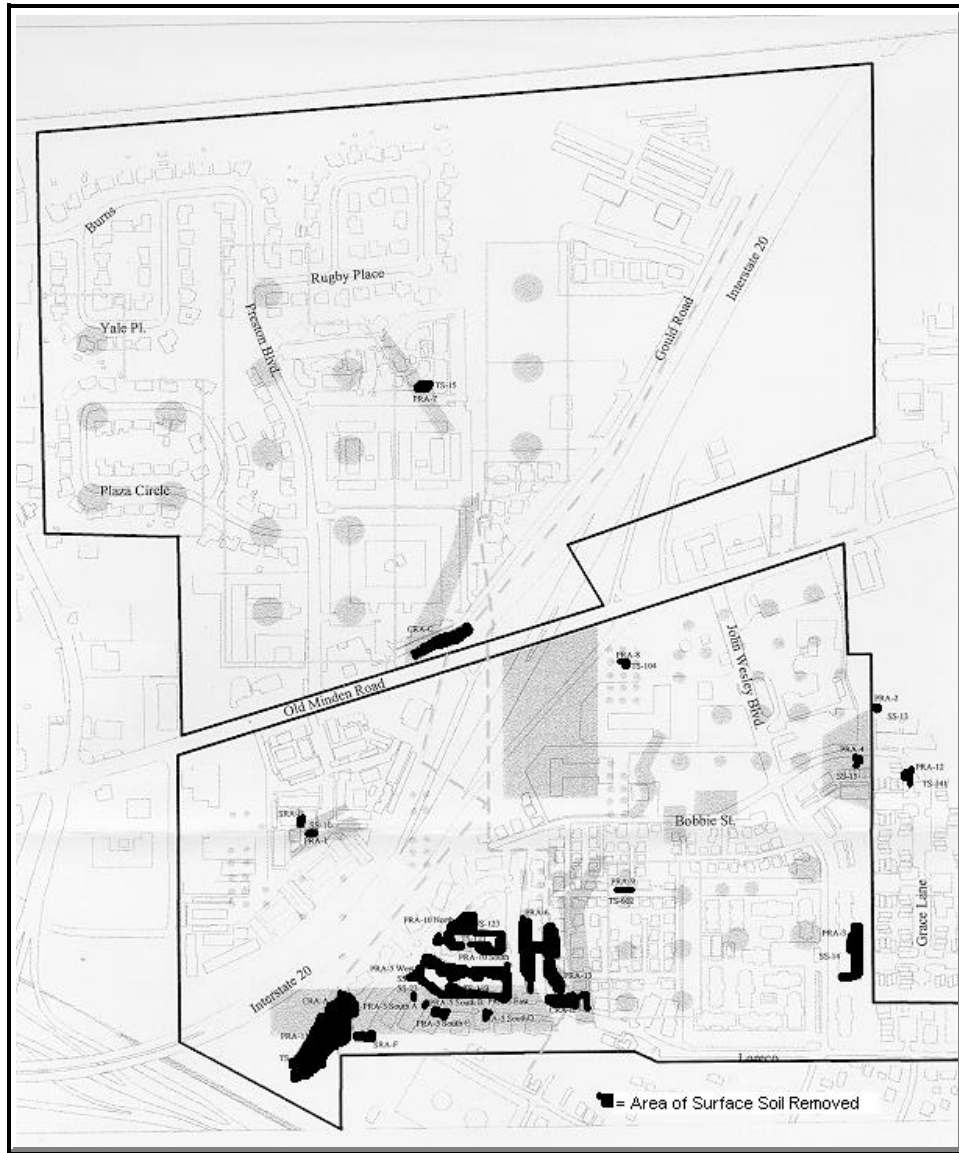


Figure 5 - Approximate Surface Soil Removal Areas

In December 1996, EPA ordered COPCO to conduct a removal action to address indoor air contamination at the Site. An indoor air removal action was conducted by GSHI on COPCO's behalf. The removal action addressed indoor air contamination at eight private residences and motel rooms in order to alleviate confirmed indoor air hazards at the Site (Conestoga-Rovers, 1997b). In early 1997, EPA used the TAGA to screen additional on-site residences for indoor air contaminants.

The Indoor Air Removal Action included sampling air in Site buildings that had not previously been sampled. The Indoor Air Removal Action also included response actions in buildings that had been previously sampled and found to be contaminated with benzene at concentration levels that exceeded 10 ppbv. EPA selected 10 ppbv benzene as the action level and cleanup level for the Indoor Air Removal Action based on site-specific data that was available at the time. A total of 32 dwelling units (e.g., homes, apartments or hotel rooms) were sampled resulting in eight dwelling units which required corrective action because they contained concentrations of benzene in indoor air that exceeded the action level. Remediation consisted of engineering controls including: sealing cracks in foundations, where accessible; sealing penetrations in walls and foundations, where accessible; and/or installing or modifying ventilation systems for the dwelling units in question (Conestoga-Rovers, 1997b). These engineering controls were designed to reduce indoor air concentrations of benzene to concentrations that were below the cleanup level. Based on the results presented in the Post-Corrective Measures Inspection Report, the corrective measures successfully reduced benzene concentrations in indoor air in the dwelling units addressed to below 10 ppbv. However, continued monitoring is necessary to ensure that the corrective measure remains effective.

In addition to the Removal Actions conducted at the Site, an LNAPL recovery program was initiated voluntarily by GSHI on behalf of COPCO in early 1997. LNAPL contains COCs including benzene. LNAPL generally floats on the ground water underlying the Site. The purpose of the LNAPL recovery program is to reduce the volume of LNAPL, which is a primary source of the indoor air contamination documented at the Site. As of December 31, 1999, 4,500 gallons of LNAPL had been recovered from the Site. LNAPL recovery technologies, including skimming and dual phase extraction, were considered among the remedial alternatives for LNAPL recovery at the Site. (Conestoga-Rovers, 1997a, 1998b, 1998c; G&E Engineering, 1998).

SECTION 3

Site Characteristics

Physical Site Characteristics

Bossier Parish lies within the upper portion of the Gulf Coastal Plain Region. Topographic relief ranges from relatively flat to strongly sloping with the entire region sloping to the south. The parish is divided into three major topographic areas: the Alluvial Valley of the Red River, the Tertiary Uplands, and the Broad Stream Terraces.

The Site is located within the Alluvial Valley of the Red River, which consists of the floodplain on the eastern side of the river and extends the full length of the western side of Bossier Parish. Based on topographic information presented on the 1975 U.S. Geologic Survey (USGS) quadrangle map of Bossier City, on-site contours range from 165 feet National Geodetic Vertical Datum (NGVD) to 170 feet NGVD. The Site is relatively flat with a gentle slope of less than 1 percent toward the Red River which is located approximately 1500 feet from the Site.

Current Land and Ground Water Use

Since 1968, the Site has been developed, and, currently, private residences, commercial buildings, and light industrial establishments cover a large portion of both the northern and southern parts of the Site (see Figure 4 and Walker, December 1999). The northwest corner of the Site contains a single-family residential development, apartment complexes, and commercial establishments. The northeastern portion of the Site contains commercial establishments and a plot of undeveloped land. The southern part of the Site is covered by several large apartment complexes, other residential areas (mainly townhouses and condominiums), and several commercial establishments including two hotels. The population of the Site is estimated at 3,500 people including approximately 370 children six years of age and younger. Based on digital photogrammetric data, approximately 52 percent of the area within the former refinery boundary is covered by pavement or buildings. Another approximately ten percent of the Site has limited accessibility due to easements for Interstate 20. Most of the rest of the Site is landscaped.

The EPA Ground Water Protection Strategy classification guidelines were used to classify the aquifer beneath the Site. The ground water beneath the Site is classified as a Class IIB aquifer. A Class IIB aquifer is one that is not currently used, but could potentially be used in the future for drinking water, agriculture, or other beneficial uses. Currently the ground water from this aquifer is not used for any of these purposes. Drinking water for on-site residents comes from the Red River which provides an abundant source of water. A well survey conducted in 1995 (Volume I, Site Characterization Report, ERM-Southwest, Inc.,

June 7, 1995) showed that only one private ground water well was located on-site. This well is not being used. This Site aquifer is not expected to be used for drinking water or irrigation in the future because of the availability of an abundant water supply, because of the high total dissolved solids in the aquifer (which makes the water unpalatable for drinking without some type of treatment), and because of a City ordinance which requires connection to the City water supply for all property owners.

Site Contamination—Investigatory Approach

Under the NCP, EPA must ensure that the public has appropriate opportunities for involvement in a wide variety of site-related decisions, including site analysis and characterization, and alternatives analysis (40 CFR § 300.430(c)(2)). Since the Site is fully developed with residential and commercial properties, the Bossier City community leaders played a heightened role in decisions regarding Site investigation. From the time the Site was proposed to the NPL, EPA considered the advice of the Mayor of Bossier City and his staff, the members of the City Council, the Bossier City Chamber of Commerce, and the U.S. Congressional delegation which represents the area that includes the Site.

Throughout the Site investigation, community leaders at the Site requested that EPA take a nonintrusive approach to Site investigation and remediation. To that end, EPA, Bossier City, LDEQ, and OXY who acted on behalf of the identified PRP, COPCO, entered into an “Agreement in Principle” (AIP) on September 10, 1995. For more information on the AIP, please consult Volume I, Section 1 of the Remedial Investigation Report by Mission Research Corporation, 1999, and the AIP itself, both of which are included in the Administrative Record File for the Site.

The AIP provided that, based on the information then in EPA's possession, the parties would work toward an agreement with the following elements (subject to NCP requirements and procedures):

1. An Administrative Order on Consent (AOC) under which OXY would conduct a physical removal action to clean up surface soil and other surficial substances with concentrations of lead which exceed 500 ppm in certain parts of the Site (this removal action was conducted under an EPA order that is more fully described in the Previous Response Actions section of this document)
2. A judicial consent decree under which the PRP would: a) pump the LNAPL from under the old refinery process area, and conduct well monitoring to confirm the results of the pumping; b) take corrective action measures regarding Site living units or work places with refinery-related indoor air pollution that posed a risk of 1×10^{-4} (or greater) increased lifetime cancer risk and/or contributes to a hazard index of one (or greater) for occupants, appropriately taking into account background levels and other sources; and c) establish

financial assurance mechanisms to assure OXY's payment of corrective action measures to address Highway 71/72 Refinery-related contamination discovered during future Site earthmoving operations

3. Implementation of restrictions on the use of Site ground water

Since the AIP, additional data and information have been generated in the course of planning and conducting removal activities at the Site (for lead in surface soil and benzene in indoor air) and during a water main break on-site in October 1999. This information, along with data which had been gathered at the time of the AIP, is included in the Administrative Record File for the Site and is discussed in the following section of this Proposed Plan.

Site Contamination - Results of Sampling

Surface Soil (0 to 2 feet below ground surface)

The COCs found in the surface soil include hydrocarbons in the form of SVOCs, such as polynuclear aromatic hydrocarbons (PAHs). The surface soil COCs also include lead, a metal. Concentrations of organic contaminants ranged from not detected (ND) to 33 ppm, with most organic contaminants measured at concentrations below one ppm (ERM-Southwest, 1994). No surface soil sampling for volatile organics such as benzene was conducted during this sampling effort.

Lead was the most prevalent metal contaminant detected at the Site in the surface soils. Lead concentrations found in samples taken prior to the Soil Removal Action ranged from 15.1 to 11,800 ppm (PRC Environmental Management, 1993) (The EPA's action level and cleanup level for the Soil Removal Action was 500 ppm lead). During surface soil sampling performed as a part of the Soil Removal Action, the maximum lead concentration detected was 41,760 ppm. The maximum lead concentration reported at the bottom of the excavations (2 feet bgs, at the top of the subsurface soils) was 155,000 ppm (Mission Research Corporation, 1998) (these excavations were backfilled with clean soil which covered any remaining concentrations of lead). Other metals were much less significant in terms of concentration and distribution (ERM-Southwest, 1994).

The RI Report indicates lead was present in significant quantities in areas of the Site associated with former refinery waste disposal areas such as the railroad tank car loading area, the tank truck loading area, and surface water impoundments of the former refinery (Figure 2). Lead contamination came from lead-contaminated waste materials that were discharged during Site refinery and storage operations (Meyer Environmental Consultants, 1996).

Recently, the EPA took samples of shallow surface soil (i.e., soil less than 2 inches bgs) at 118 on-site residential yards. The EPA took at least two samples per yard. The EPA found that none of the yards sampled had an average soil lead concentration that exceeded 500 ppm. Site residents should be aware, however, that lead contamination could still exist in residential yard soil at depths greater than 2 inches bgs. In fact, historical documents suggest that a thin layer of clean soil may have been placed over areas of contaminated soil on the Site. Although all known areas of surface soil with concentrations of lead that exceeded 500 ppm were removed during the 1996-1997 Soil Removal Action, EPA believes that concentrations of lead contamination in residential yard surface soils at depths greater than 2 inches bgs may still present a threat to human health (especially children's health) should these soils be uncovered during excavation (e.g., during gardening or underground utility repair).

Subsurface Soil (greater than 2 feet below ground surface)

"Subsurface" or "Deeper" soil was sampled by ERM-Southwest, Inc., as part of a Site investigation for GSHI (ERM-Southwest, 1994). These deeper soil samples were collected during the drilling of deep boreholes. Monitoring wells were later installed into some of these deep boreholes for the purposes of ground water monitoring and sampling. Lead was found in several areas within the subsurface soil. Hydrocarbon-contaminated subsurface soil was detected primarily on the southern half of the Site in areas associated with former refinery features.

Contaminants detected in the deeper soil included the following: hydrocarbons in the form of VOCs, such as benzene, toluene, ethylbenzene, and xylenes (BTEX); SVOCs, including several PAHs; and several metals, including lead. Concentrations of the hydrocarbon contaminants in the subsurface soils ranged from ND to 110 ppm, though most of these contaminants were detected at concentrations ranging from ND to 10 ppm (ERM-Southwest, 1994). Lead, the most prevalent inorganic contaminant in the subsurface soils, was detected at concentrations ranging from ND to 3,980 ppm; though most of the lead concentrations ranged from 1 to 40 ppm (ERM-Southwest, 1994).

High levels of hydrocarbon contamination occur primarily on the southern half of the Site in the areas formerly used for gasoline blending, gasoline storage, railroad tank car repair yard, tank truck loading, and surface water impoundments (Figure 2).

The volume of soil (surface and subsurface) potentially contaminated with refinery-related wastes has been estimated by EPA at approximately 645,000 cubic yards. This approximation is based on an estimate that about 30 acres of the Site were contaminated with wastes during Site operations, that an additional 10 acres of the Site were contaminated during Site redevelopment (i.e., grading of the Site, moving contaminated soil into uncontaminated areas, etc.), and that soils are contaminated to a depth of 10 feet bgs (average depth to the water table). Since approximately 52 percent of the Site is

covered by pavement and/or buildings, the volume of affected soil in uncovered areas is estimated to be 310,000 cubic yards.

The EPA believes that subsurface soil contamination does not present a significant human health or environmental threat through direct contact or ingestion unless these contaminants are brought to the surface (e.g., during earthmoving). However, subsurface soil contamination could be acting as a source of contamination of the indoor air and ground water.

Surface Water

Surface water was sampled by ERM-Southwest, Inc., to determine whether surface water quality had been contaminated by past Site activities. Surface water samples were collected from eight locations. Most of the surface water sample locations contained trash and debris (including concrete pieces, scrap metal, oil filters, plastic, paper, and organic matter) that were not related to use of the Site as a refinery.

No VOCs were detected in any of the samples collected from locations impacted by runoff from the Site. Four VOCs were detected in the background samples located upstream of the Site. One SVOC, bis(2-ethylhexyl)phthalate, was detected in both on-site and background samples. The concentrations of bis(2-ethylhexyl)phthalate detected in surface water samples representing Site conditions (SW-1, SW-2, and SW-4) were similar to the concentration detected in a background sample (SW-3). Twelve inorganic compounds were detected in surface water samples. The concentration ranges of inorganic constituents detected in surface water samples were similar to the ranges detected in samples collected from background/upstream locations (ERM-Southwest, 1994).

Based on these results, the surface water channels on and near the Site do not appear to be contaminated with constituents related to past refinery activities.

Ground Water

As stated above, the EPA Ground Water Protection Strategy classification guidelines were used to classify the aquifer beneath the Site to assist in determining the appropriate remediation method for shallow ground water underlying the Site (U.S. EPA, 1988b). Ground water samples were collected from two Site ground water monitoring wells and analyzed for total dissolved solids (TDS). Ground water from monitoring well MW-63 was found to contain 798 mg/L TDS and ground water from monitoring well PZ-4-97 showed 1810 mg/L TDS (G&E Engineering, 1997c). The secondary drinking water standard (for taste and aesthetics) for TDS is 500 mg/l.

Shallow ground water underlying the Site has been sampled on several occasions for site-related contaminants since the installation of monitoring wells in 1993. Samples were collected from monitoring wells installed into the uppermost water bearing unit located at the Site. Ground water within this upper unit has been found to be contaminated by refinery wastes both in the dissolved phase and as LNAPL floating on the surface of the ground water.

The occurrence of LNAPL is a likely result of refinery waste moving downward from disposal areas under the influence of gravity through the alluvial sediment underlying the Site. LNAPL is present in some Site monitoring wells at thicknesses ranging from a thin sheen to more than 15 feet (G&E Engineering, 1998). The ground water contamination at the Site is likely related to the presence of LNAPL and other underground hydrocarbon waste sources including waste in soil. Concentrations of VOCs in the ground water ranged from ND to 49.0 ppm. Most ground water samples had concentrations of VOCs that were below one ppm. Concentrations for SVOCs ranged from ND to 4.20 ppm. Most SVOC concentrations were below one ppm. Concentrations of lead ranged from ND to 0.154 ppm and chromium ranged from ND to 0.24 ppm.

The lateral and vertical extent of the ground water plume was estimated based on available information. Three thick LNAPL plumes (identified as plumes A, B, and C) were identified at the Site based on soil and ground water sampling (Figure 4). The estimated volume of LNAPL in Plumes A, B, and C is approximately 325,000 gallons. The estimated volume of ground water contamination (in addition to the LNAPL contamination) is approximately 160,000,000 gallons. These estimates are based on an estimate that 32 acres of the Site are impacted by LNAPL, as detected in borings, and on an average saturated thickness of 15 feet. An LNAPL plume is present beneath Indoor Air Quality Impairment Zone 1 (this plume is also referred to as "Zone 1" in this Proposed Plan), although no volume of potential contamination in the Zone 1 plume has been calculated because data is limited. (The LNAPL in Zone 1 appears to be a thin layer much less than 15 feet thick.) The EPA has also found that there is hydrocarbon contamination underlying Indoor Air Quality Impairment Zone 2, and, again, data is limited, but at this time the thickness of the LNAPL in this zone (a sheen) does not appear to be such that the LNAPL in this zone should be addressed as part of the remedial action.

The EPA believes that LNAPL presents a significant threat to human health because it contaminates ground water which may be ingested. The EPA also believes that LNAPL presents a significant threat to human health because it volatilizes, migrates to the surface as soil gas, enters buildings through foundation openings, and impacts indoor air.

Soil Gas/Vapor Phase

A soil gas survey was conducted in September 1992 by OXY contractor Exploration Technologies, Inc. (1993) to investigate the nature and extent of previously detected Soil gases and their potential sources. The Soil gas survey was used as a screening tool to identify areas of concern. The results of the Soil gas survey were utilized to specify some of the borehole and monitoring well locations and to identify indoor air screening locations.

Soil gas samples from 898 locations were collected from depths of approximately 2.5 to 7.0 feet bgs at locations throughout the Site. Each sample was analyzed for light hydrocarbon gases including methane, ethane, propane, butanes, and the C5 plus (gasoline range) compounds. Two deep reservoir gas samples were also collected from commercially producing gas wells in the area and analyzed to determine if there were any similarities to the shallow soil gases. The reservoir gas samples were also analyzed for the compounds listed above in this paragraph, as well as for stable isotopes of carbon in order to help determine the origin of the shallow soil gases. Some samples were also analyzed for BTEX compounds, and for nitrogen, oxygen, and carbon dioxide.

The results of the soil gas survey indicate that the highest hydrocarbon gas concentrations are generally found in the southern half of the Site. The composition of the deep reservoir gas samples was different from the typical shallow soil gas samples, thus suggesting that a portion of the soil gas is not originating from deep reservoir gas. Low oxygen and high methane content in shallow soil gas indicate potential biological decomposition of underground hydrocarbon compounds. The highest soil gas readings tend to be concentrated in the area where ground water monitoring results indicate the presence of a large plume of LNAPL (Plume A). However, the soil gas readings were also high along the old impounded bayous, which indicates the potential presence of organic material remaining from past refinery waste activities. High soil gas concentrations also occurred in the former railroad tank car repair yard where hydrocarbon-saturated soil was detected in boreholes, and LNAPL was detected in measurable quantities in these same boreholes during earlier sampling episodes.

The EPA believes that contaminated soil gas migration to indoor air presents the potential for a significant public health threat at this Site.

Indoor Air

Resident complaints of indoor odors were common from 1990 to 1996 on the Site. In 1990, at the direction of LOPH, 47 families were evacuated from an apartment complex because elevated levels of methane and other hydrocarbon gases were detected in some apartments. Two hotels frequently closed several first floor rooms because of hydrocarbon odor complaints by customers.

In September 1993, OXY completed an indoor air screening and monitoring event through its contractor, Law Environmental (1994). Indoor air screening measurements were conducted three times per month over a three-month period in 419 ground floor locations on the Site. Selected locations were surveyed on a more frequent basis. For screening purposes, total hydrocarbons in the air were measured with an organic vapor analyzer (OVA). Additionally, 49 single event air samples were collected at 36 selected homes, apartments, and commercial buildings on the Site. The contractor took 36 breathing-space samples and 13 wall-space samples. In homes where chemical specific analysis was performed, hydrocarbon gases (benzene, toluene, m,o,p-xylene, o-xylene, methane, ethane, propane, n-butane, n-pentane, n-hexane, n-heptane, and n-octane) were detected in certain ground floor locations.

In June 1996, EPA conducted an indoor air sampling study on the Site using EPA's Trace Atmospheric Gas Analyzer (TAGA). The TAGA is an air sampling instrument which detects very low concentrations of organic chemicals simultaneously in both indoor and outdoor air. The results of the TAGA indoor air screening showed contaminant concentration levels above the ambient (or background) outdoor concentration level. The concentrations of contaminants in indoor air were three times outdoor background concentrations for benzene, toluene, and/or xylenes in 48 of the 92 dwelling units tested (Weston, 1996). Additional monitoring and analysis was conducted at 32 dwelling units based on the results of the TAGA screening. Five of these units showed benzene levels above 10 ppbv. The results of a second TAGA indoor air screening conducted in January through March 1997, indicated elevated levels of benzene, toluene, and/or xylenes in nine of the 72 dwelling units tested.

Additional testing of indoor air in 37 Site dwelling units during the Indoor Air Removal Action found benzene levels above 10 ppbv in three indoor locations. Corrective measures (e.g., crack sealing, HVAC modification) were required in eight dwelling units.

The EPA believes that elevated benzene concentrations detected in Site indoor air originate from the migration of soil gas into structures. Weather patterns, including rainfall events and rising and falling ground water levels, influence the migration of soil gas through the subsurface. Cracks in foundations and penetrations in walls and foundations serve as conduits for soil gas migration into indoor air on the Site. An increase in structural integrity, and certain ventilation methods may prevent both the migration of soil gas into structures and the potential build-up of contaminants within structures.

Although the Indoor Air Removal Action mitigated known indoor air quality problems in the dwelling units which were tested, EPA believes that the potential still exists for Site-related contaminants to impact indoor air quality in the future, since the sources of indoor air contamination still exist and the integrity of on-site structures may deteriorate with age.

Principal and Low-Level Threat Wastes

Principal threat wastes are wastes that cannot be reliably controlled in place, such as liquids, highly mobile materials (e.g., solvents), and high concentrations of toxic compounds (e.g., several orders of magnitude¹ above levels that allow for unrestricted use and unlimited exposure). The EPA expects that treatment will be the preferred means to address the principal threats posed by a site, wherever practicable. Low-level threat wastes are those source materials that generally can be reliably contained and that contain contaminant concentrations not greatly above the acceptable levels. Examples of low-level threat wastes include non-mobile contaminated source material of low toxicity and low concentrations of low toxicity source material. Principal threat and low-level threat wastes associated with the Site are as follows:

Light Non-Aqueous Phase Liquids

LNAPL that is found floating on the ground water which underlies the Site is a principal threat waste because concentrations of constituents of concern in this LNAPL are very high. The LNAPL may volatilize into soils, migrate to the surface, and accumulate in the air inside buildings located on the Site, and the resulting concentrations of COCs in indoor air may be substantially above concentration levels which pose an unacceptable risk to human health. LNAPL may be found floating on the ground water or as residual materials sorbed to soils; however, only the LNAPL found floating on the ground water is of a high enough concentration to be considered a principal threat waste at the Site.

Ground Water

The EPA considers BTEX in ground water at the Site to be a principal threat waste because contaminant concentrations are substantially above concentration levels that pose an unacceptable risk to human health, if humans were exposed to the ground water. The contaminated ground water is not currently used by the citizens of Bossier City.

Based on the presence of an extensive source area that will remain at the Site (i.e., contaminated subsurface soil) and, based on the nature and extent of the contaminated ground water plume as described in the previous paragraph, EPA believes that it is technically impracticable to remediate the ground water contamination at the Site. Consequently, EPA is proposing a technical impracticability (TI) waiver of ground water Applicable, Relevant and Appropriate Requirements (ARARs) at the Site (see 40 CFR § 300.430 (f)(1)(ii)(C)). Under EPA's preferred remedy, the threat to human health posed by contaminated ground water at the Site will be addressed by preventing human exposure

¹An order of magnitude is a tenfold difference.

through institutional controls (i.e., banning the use of ground water from the contaminated aquifer in the vicinity of the Site) implemented by Bossier City. Removing the LNAPL associated with ground water will reduce, but not eliminate, ground water contamination. These LNAPL sources are also the primary source of Site-related indoor air contamination.

Lead-Contaminated Surface Soil

Lead-contaminated surface soil at the Site is not classified by EPA as principal threat waste under EPA standards; however, should soil lead concentrations at the Site residential areas be found to be above health-based cleanup standards, these soils would pose a significant low-level threat to human health (young children are especially affected by small amounts of lead). The PRP has undertaken removal actions to address known areas of lead contaminated soil, mainly in residential areas on the southern part of the Site. Based on limited data and information gathered during the RI, including historical accounts, analysis of aerial photographs, professional opinions, and the testimony of a former Site refinery worker, the EPA believes that other areas on the Site may also be contaminated with lead in subsurface and surface soil deeper than two inches bgs; however recent EPA sampling events have found no residential yards on the Site that contain average concentrations of lead that exceed 500 ppm in the shallow surface soil (i.e., the top two inches). Based on EPA's experience with lead-contaminated soil on the Site so far, it is not likely that soil lead concentrations on the rest of the Site will be of the magnitude of a principal threat waste. That is, soil lead concentration levels are not likely to be several orders of magnitude above levels that allow for unrestricted use and unlimited exposure. Moreover, lead generally adheres to soil and is not highly mobile in the environment.

Organic-Contaminated Waste in Soils

Based on the information that EPA has, organic-contaminated waste in soils at the Site is not a principal threat because concentrations of organic contaminants in the soil are not likely to be several orders of magnitude above levels that allow for unrestricted soil use and unlimited exposure. However, this material is a low-level, but significant threat because of the possibility of human exposure, through dermal contact or through breathing fumes, to unacceptable levels of contaminants in the hydrocarbon-contaminated waste, should it be uncovered during earthmoving activities. In addition, organic-contaminated material at the Site appears to be somewhat mobile in that it is generally found in an oily layer in which there are visual indications of seeps through preferential pathways in the soil.

Scope and Role of Response Action

As discussed in the section of this document regarding previous response actions, several removal actions have been conducted to address lead-contaminated surface soils at the Site, and to address indoor air contamination at private residences and motel rooms at the Site.

The EPA expects that the remaining Site contamination will be addressed as one operable unit through the remedy selected in the ROD which will be issued following this Proposed Plan. (An operable unit is a discrete action that comprises an incremental step toward comprehensively addressing Site contamination.) That is, the response action, which will be detailed in the Site ROD, will address the principal threat wastes (the light non-aqueous phase liquids) and the low-level, but significant, threat wastes (the lead and hydrocarbon-contaminated waste which is discovered or becomes uncovered in other areas of the Site.)

SECTION 4

Summary of Site Risks

Baseline Risk Assessment Findings

Contaminants of Concern (COCs)

Overall, the Site COCs identified by the March 1999 Baseline Risk Assessment represent constituents typical of the materials present at petroleum refineries. There were also sporadic detections of chlorinated hydrocarbons in soil and ground water, and the metals arsenic, barium, manganese, chromium, aluminum, and vanadium in ground water. For soil, the COCs include lead, benzene, and PAHs. For indoor air, the COCs include BTEX. For hydrocarbon-contaminated soil, the COC selection at the Site is based on site-specific data and upon knowledge of other sites with similar wastes since Site analytical data is limited. The COCs were retained for risk evaluation based upon toxicity, frequency of detection, and concentration. They also represent the contaminants that contribute most significantly to human health risks at the Site.

Land and Ground Water Use Assumptions

The reasonably anticipated future land use at the Site, projected for the purposes of the Baseline Risk Assessment, is the same as the current use-- residential and commercial. This future land use projection is based on current conditions at the Site which is fully developed with single-family residences, apartments, hotels, and businesses. Land use adjacent to the Site consists of residential development to the east and south, and commercial developments to the west and north.

The reasonable anticipated future ground water use at the Site, projected for the purposes of the Baseline Risk Assessment, is residential use including drinking and showering. This projected future scenario must be used in the risk assessment because the ground water beneath the Site is classified as a Class IIB aquifer, which is one that is not currently used, but could potentially be used in the future for drinking water, agriculture, or other beneficial uses.

Exposure Scenarios

In the exposure assessment part of the Baseline Risk Assessment, a detailed evaluation was completed for each area of concern at the Site. This evaluation included identification and characterization of contaminant sources and release mechanisms, transport media, exposure points, exposure routes, and human receptors. Human receptors identified and assessed included on-site residents, commercial and utility workers, and transient hotel residents. Both current and future land use scenarios were considered in the exposure assessment.

Exposure Pathways (Routes of Exposure)

The Baseline Risk Assessment identified primary contaminant sources, contaminant release mechanisms, exposure pathways, and receptors for the COCs. For future and current land use scenarios (which are the same at the Site), human chemical intakes were calculated for inhalation of indoor air, for ingestion of ground water, for ingestion of soil including dust and volatiles, and for dermal contact with soil, surface water, and ground water.

Toxicity Assessment

Site contaminants were assessed for carcinogenicity and for non-carcinogenic systemic toxicity. The incremental upper bound lifetime cancer risk, presented in this Proposed Plan as the “carcinogenic risk,” represents the additional site-related probability that an individual will develop cancer over a lifetime because of exposure to a certain chemical (i.e., greater than the general nationwide lifetime risk of cancer). To protect human health, EPA has set the acceptable risk range for carcinogens at Superfund Sites from 1 in 10,000 to 1 in 1,000,000 (expressed as 1×10^{-4} to 1×10^{-6}). A risk of 1 in 1,000,000 (1×10^{-6}) means that one person out of one million people could be expected to develop cancer as a result of a lifetime exposure to the site contaminants. Where the aggregate risk from COCs based on existing ARARs exceeds 1×10^{-4} , or where remediation goals are not determined by ARARs, EPA uses the 1×10^{-6} as a point of departure for establishing preliminary remediation goals. This means that a cumulative risk level of 1×10^{-6} is used as the starting point (or initial “protectiveness” goal) for determining the most appropriate risk level that alternatives should be designed to attain. Factors related to exposure, uncertainty and technical limitations may justify modification of initial cleanup levels that are based on the 1×10^{-6} risk level.

For non-carcinogenic toxic chemicals, the toxicity assessment is based on the use of reference doses (RfDs) whenever available. A reference dose is the concentration of a chemical known to cause health problems. The estimated potential site-related intake of a compound is compared to the RfDs in the form of a ratio, referred to as the hazard quotient (HQ). If the HQ is less than one, no adverse health effects are expected from potential exposure. When environmental contamination involves exposure to a variety or mixture of compounds, a hazard index (HI) is used to assess the potential adverse effects for this mixture of compounds. The HI represents a sum of the hazard quotients calculated for each individual compound. HI values that approach or exceed one generally represent an unacceptable health risk that requires remediation.

There are no available RfDs with which to assess exposure to lead in an environmental medium. Although EPA considered several methods for selecting a soil lead remediation goal, including slope studies, direct blood-lead measurements, and IEUBK modeling, EPA decided to use the Integrated Exposure Uptake Biokinetic (IEUBK) Model in the Baseline Risk Assessment to assess potential chronic exposures of children receptors to lead in drinking water and soil at the Site. The IEUBK Model is a computer model that estimates human health risk based on data gathered at a lead-contaminated site. Model input includes measurements of lead in indoor dust, measurements of lead in tap water, and measurements of lead in soil. Default parameters are utilized for any medium for which site-specific data does not exist. The EPA recommends that, for soil lead, a remediation goal be selected such that a typical child or group of children exposed to the soil in question would have an estimated risk of no more than five percent of exceeding a blood lead concentration of 10 micrograms per deciliter (: g/dL) (EPA July 1994). In this Proposed Plan, this five percent is referred to as the five percent benchmark. The Centers for Disease Control (CDC) says that blood lead levels at least as low as 10 : g/dL are associated with adverse health effects in children (CDC, 1991).

Human Health Risk Characterization

Risk estimates were calculated for current and future land use scenarios for hypothetical human receptors at the Site. Cancer risks were estimated as the probability of an individual developing cancer over a lifetime as a result of exposure to carcinogenic contaminants. Toxicity risk estimates for noncarcinogenic toxic chemicals are presented for COCs where toxicity values were available. The potential for noncarcinogenic hazards due to potential exposures to chemicals was evaluated by calculating an HI for the COCs at the Site. As explained above, risk from lead was evaluated separately using the IEUBK model.

Appendix D of the Baseline Risk Assessment shows the detailed calculation of risk. Total risks, from both site-related COCs and non-site-related contaminants are shown in the following table:

Total Cancer and Non-Cancer Risk Estimates

Population	Total Cancer Risk Estimate	Total Hazard Index Estimate
Child Resident	3×10^{-2}	507
Adult Resident	5×10^{-2}	224
Lifetime Resident	8×10^{-2}	325
Transient Hotel Resident	2×10^{-6}	Not Applicable
Commercial Worker	2×10^{-4}	14
Utility Worker	3×10^{-7}	0.004

The Baseline Risk Assessment organized the types of risk at the Site according to various exposure scenarios. Each exposure scenario specifies the type of human receptor (e.g., child resident, adult utility worker), the exposure pathway (e.g., inhalation, ingestion) and the COC. If a contaminant or exposure scenario is found to produce a risk which will require a remedial action (based on either the carcinogenic risk or the HI) that contaminant or exposure scenario is said to “drive the risk” or “drive” the need for action. A remediation goal is set for site-related contaminants that drive risk. The following exposure scenarios are driving the need for action at the Site (all carcinogenic risks are expressed as Reasonable Maximum Exposure or RME):

Indoor Air

Carcinogenic Risks: For the exposure scenario based on the potential inhalation of indoor air, benzene is driving the risk for the carcinogenic compounds for adult and child residents. Cancer risk from this indoor air contaminant for adult residents is 5×10^{-5} and 1×10^{-5} for child residents. Benzene in indoor air also drives the risk for adult commercial workers at 2×10^{-4} .

Non-Carcinogenic Risks: For the exposure scenario based on potential inhalation of contaminated indoor air, benzene is also the contaminant driving the risk based on its toxic but non-carcinogenic health effects. The HI for adult and child residents and adult transient hotel residents is about 3. The HI for an adult commercial worker is 1.21.

Ground Water

Carcinogenic Risks: For the exposure scenario based on the potential ingestion of contaminants in ground water, benzene is driving the risk for the carcinogenic compounds for adult and child residents. Cancer risk from these ground water contaminants for adult residents is 1×10^{-2} and 8×10^{-3} for child residents.

For the exposure scenario based on the potential inhalation of contaminants in ground water while showering, benzene is driving the carcinogenic risk for both adults and children at 3×10^{-2} . For the exposure scenario based on potential dermal exposure while showering, benzene is driving the risk for adult residents at 3×10^{-4} and 2×10^{-4} for child residents.

Non-Carcinogenic Risks: For the exposure scenario based on the potential ingestion of contaminants in ground water, several contaminants are driving the non-carcinogenic risk; however, these contaminants (mainly arsenic and manganese) were not found to be Site-related.

For the exposure scenario based on inhalation of contaminants in ground water while showering, benzene is driving the non-carcinogenic risk for adult residents with an HI of 324.

Surface Soils

This discussion of surface soils does not include a discussion of the adverse health risks due to potential exposure to lead which are discussed separately in a later section.

Carcinogenic Risks: For the exposure scenario based on the incidental ingestion of chemical contaminants in surface soil, the additive carcinogenic risk from all contaminants is 5×10^{-6} for adult residents, 1×10^{-5} for child residents, and 2×10^{-6} for commercial workers. The risks due to carcinogenic compounds in the surface soil drive the risk in this medium. Specifically, the contaminants driving the risk in the surface soil are carcinogenic polycyclic aromatic hydrocarbons (PAHs) a group of compounds which include benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, carbazole, chrysene, dibenz(a,h)anthracene, bis(2-ethylhexyl)phthalate, hexachlorobenzene, and indeno(1,2,3-cd)pyrene.

Based on limited data and information gathered during the RI, including historical accounts, analysis of aerial photographs, professional opinions, and the testimony of a former Site refinery worker; based on EPA knowledge of other similar refinery sites; and based on photographic evidence from the removal actions and the October 1, 1999, water main break, EPA believes that there is likely hydrocarbon-contaminated waste in residential area surface soils on the Site. This hydrocarbon-contaminated waste likely includes benzene as a contaminant at high enough concentrations to cause an unacceptable risk. Therefore, remediation goals for benzene in surface soils have also been set.

Subsurface Soils

This discussion of the subsurface soils does not include a discussion of the adverse health risks due to potential exposure to lead which are discussed separately in a later section.

Carcinogenic Risks: Risks to a utility worker due to inhalation of volatilized contaminants from subsurface soil trenches, and due to incidental ingestion of subsurface soil, were calculated. The risk was found to be in an acceptable range for this exposure scenario. The dermal contact carcinogenic risks were in the range of 1×10^{-8} and the HIs were in the range of 0.001.

Based on limited data and information gathered during the RI, including historical accounts, analyses of aerial photographs, professional opinions, and the testimony of a former site refinery worker; based on EPA knowledge of other similar refinery sites; and based on photographic evidence from the removal actions and the October 1, 1999, water main break, EPA believes that there is likely to be hydrocarbon-contaminated waste in subsurface soils on portions of the Site.

Although new analytical data has not been gathered, the presence of the black-stained soil layer up to six feet deep in the trench excavated in order to repair the water main (Bossier City Fire Department, 1999) suggests that there are several other possible exposure scenarios. These exposure scenarios include a child trespasser who could be exposed to the material during utility repairs or other construction activities, and also include both adult and child residents who could potentially be exposed to the material while digging in their yards.

Until more data is gathered about the constituents in the black-stained soil, EPA considers incidental ingestion of subsurface soil, dermal contact with subsurface soil, and inhalation of vapors from subsurface soil potential COC exposure pathways which may pose unacceptable risks to human health. This hydrocarbon-contaminated waste likely includes benzene and carcinogenic PAHs as contaminants at high enough concentrations to cause an unacceptable risk. Therefore, remediation goals for benzene and PAHs in subsurface soils have been set.

Surface Water

Risk from dermal contact with surface water during wading for a child trespasser was calculated and was not found to be in an unacceptable range. The dermal contact carcinogenic risks were in the range of 1×10^{-8} and the HIs were in the range of 0.001.

Sediment

Sediment samples were not taken and, thus, a risk from sediment was not calculated.

Risks from Lead

Since there are no EPA-approved RfD values for lead, it is not possible to evaluate the noncancer toxic risks of lead by calculation of a Hazard Index. An alternative approach is to estimate the likely effect of lead exposure on the concentration of lead in the blood of the children living on-site using the IEUBK model. The IEUBK model was used in the Site Baseline Risk Assessment to assess potential chronic exposures of children receptors to lead in ground water and soil. In the Site Baseline Risk Assessment, model default parameters were used for all exposure pathways except the soil ingestion pathway because the soil ingestion pathway was the only pathway for which data had been gathered at that time. (Additional data from several media were gathered recently so that a Site-specific lead remediation goal could be developed using the IEUBK model. This is further discussed in Basis for the Selection of Remediation Goals Section of this document.) The modeling performed for the Site Baseline Risk Assessment produced a probability function that predicted the likelihood of elevated blood lead concentrations in child residents. In the case of potential exposure to lead-contaminated surface soil, using available data and certain assumptions, the estimate of the percentage of child residents expected to have blood lead concentration levels in excess of the 10 : g/dL criterion established by CDC was greater than five percent. Since the risk from lead was determined to be greater than the five percent benchmark, lead was retained as a COC which drives the risk in the soil medium and a remediation goal was set.

Ecological Risk Characterization

One of the first steps in performing an ecological risk assessment is evaluating whether or not there is a pathway of exposure for ecological receptors. At the Highway 71/72 Site, EPA considered several factors in this evaluation: the urban setting of the Site, the developed nature of the Site (i.e., much of the Site is paved or covered with commercial establishments and residential buildings), and the fact that a major interstate highway and several multi-lane state highways transect the Site. In addition, EPA considered the input of the U.S. Department of the Interior (DOI, April 22, 1998, and January 5, 2000.) The EPA concluded that continuing with an ecological risk assessment was not appropriate for the Site because there was an incomplete exposure pathway to ecological receptors.

Basis for Action

It is EPA's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

SECTION 5

Remedial Action Objectives And Goals

Remedial Action Objectives

The EPA proposes the following remedial action objectives (RAOs) for this Site:

Soil Media Remedial Action Objectives

1. Prevent human (especially child) ingestion of lead-contaminated surface and subsurface soil with lead concentrations that exceed 510 ppm.
2. Prevent human ingestion of, and prevent human dermal contact with, surface and subsurface soils containing carcinogenic PAHs at concentrations greater than 1 ppm benzo(a)pyrene (BAP) equivalents, or benzene at concentrations greater than 1 ppm.
3. Prevent human ingestion of, and prevent human dermal contact with, soils containing other site-related compounds that present a carcinogenic risk greater than 1×10^{-6} or a HI greater than 1.
4. Reduce and/or eliminate the potential for soils to be impacted by COCs present in refinery waste materials located in the subsurface by removing LNAPL from ground water until the performance standard (a threshold thickness of 0.1 foot of LNAPL, measured using an interface probe in monitoring or extraction wells) is attained.

Indoor Air Remedial Action Objectives

1. Prevent human inhalation of concentrations of benzene in indoor air that exceed 3 ppbv benzene.
2. Reduce and/or eliminate the potential for indoor air to be impacted by COCs present in refinery waste materials located in the subsurface by removing LNAPL from ground water until the performance standard (a threshold thickness of 0.1 foot of LNAPL, measured using an interface probe in monitoring or extraction wells) is attained.

Ground Water Remedial Action Objectives

1. Prevent human ingestion or inhalation of ground water containing site-related COCs at concentrations which exceed the corresponding Maximum Contaminant Level Goals (MCLGs) established under the Clean Water Act (CWA) that are set above zero for these COCs. Alternatively, prevent human ingestion or inhalation of ground water containing CWA Maximum Contaminant Levels (MCLs) of these COCs when the corresponding MCLGs are set at zero.
2. Reduce and/or eliminate the potential for ground water to be impacted by COCs present in refinery waste materials located in the subsurface by removing LNAPL from ground water until the performance standard (a threshold thickness of 0.1 foot of LNAPL, measured using an interface probe in monitoring or extraction wells) is attained.
3. Prevent human ingestion or inhalation of ground water containing Site-related COCs at concentrations which exceed the corresponding non-zero MCLGs (or MCLs where the corresponding MCLGs equal zero) by monitoring to ensure that concentrations of site-related COCs do not exceed remediation goals in Site ground water that may migrate to an area that is not within the area under the jurisdiction of the City's ban on ground water use.

Basis for Selection of Remediation Goals

A Remediation Goal is the allowable concentration of a contaminant which may remain in a specific medium (such as soil or indoor air) at a site after implementation of the ROD through the Remedial Action. Generally remediation goals are based on ARARs. Where no ARARs exist or where ARARs are not sufficiently protective, the NCP prescribes methods for selection of remediation goals. There are no ARARs for Site soil or indoor air; consequently, according to NCP procedure, remediation goals were selected based on risk to human health. That is, soil and indoor air remediation goals were selected that correspond to risk levels that are acceptable under the NCP. For ground water remediation goals, in keeping with the NCP, EPA identified non-zero MCLGs (or MCLs where MCLGs equal zero) as ARARs; however, as explained in this Proposed Plan, EPA is proposing a waiver of ARARs for ground water because compliance with ground water ARARs is technically impracticable from an engineering perspective.

The basis for the selection of remediation goals for soil and indoor air is detailed in three memoranda prepared by EPA toxicologist Dr. Jon Rauscher which are a part of the administrative record file for the Site (Rauscher, January 2000 and March 2000). A discussion of Site conditions which will be part of the basis for the technical impracticability waiver for ground water ARARs is included in a memorandum prepared by

EPA hydrologist, Mr. Vincent Malott which also is a part of the administrative record file for the Site (Malott, January 2000). The same memorandum by Mr. Malott explains the basis for the performance standard selected for LNAPL extraction. The remediation goals and the performance standard selected for the Site are consistent with the NCP, with EPA policy and with remediation goals at other EPA Region 6 Sites. The basis for each remediation goal is summarized below.

Lead in Soil

Remediation goals for lead were calculated on a Site-specific basis using the IEUBK model. Input parameters for this model include lead concentration data from Site soils, indoor dust in homes, and tap water, among other data. For this Site, except for limited data on lead in Site soils, these types of data were not collected prior to the release of the RI Report. Therefore, EPA Region 6 undertook a limited sampling effort in February and March 2000 in order to acquire the data necessary to run the IEUBK model and calculate a Site-specific remediation goal. The concentration of 510 ppm is the soil lead concentration that corresponds with an estimated risk of no more than five percent that a typical child or group of children living on the Site would have a blood lead concentration greater than or equal to 10 : g/dL. (See Rauscher, March 2000.)

This remediation goal is different than the action level set for lead during the Site removal actions because that action level was based on knowledge gained from another EPA Region 6 Site, the RSR Superfund Site, and on data collected at that site. At the time that EPA selected the Soil Lead Removal Action for the Site, EPA could have run the IEUBK model using the Site soil lead data along with default values for indoor dust and tap water. However, EPA decided that it was more appropriate to base its cleanup level on knowledge gained from EPA's experience at the RSR Corporation Site because EPA believed that using data and experience from an actual site would be more likely to produce an appropriate action level and cleanup level than would reliance on the IEUBK model's default values. At RSR, any area where contamination was found was excavated to a depth of 6 inches, then retested until the cleanup level was reached or until the excavated area reached 2 feet bgs. Since soil lead concentrations decreased with depth at RSR, the final 6-inch lift in any given area generally contained clean soil which was under the contaminated soil; consequently, the target cleanup level of 500 ppm actually attained a lower cleanup level.

Based on results at RSR, EPA assumed the Site Soil Lead Removal Action would attain similar results. However, data acquired during the Highway 71/72 Site removal action showed that lead concentrations actually increased with depth in many cases. Evidently the difference between the Site and RSR is the manner in which the lead was deposited. At RSR, lead concentrations almost invariably decreased with soil depth. During the Site soil lead removal action, EPA found that there was no consistent pattern to changes in soil lead concentrations as excavations went deeper, but, generally, lead concentrations increased at

depth. In fact, the highest soil lead concentration was found at 2 feet bgs in one excavated area. EPA's finding that there are random concentrations of soil lead on the Site is consistent with EPA's belief, based on analysis of aerial photographs taken during the clearing of the Site, that contaminated soil was bulldozed and spread throughout the Site. Since the method used to select the action level and cleanup level for the Soil Lead Removal Action was found to be inappropriate for conditions at the Site, EPA used a different method for selecting the remediation goal for the Remedial Action. EPA considered several methods for selecting a soil lead remediation goal including slope studies, direct blood-lead measurements, and IEUBK modeling. EPA decided to run the IEUBK computer model using data that was actually gathered at the Site. Since the IEUBK model considers all sources of lead that may affect children, samples of indoor dust, yard soil, and tap water were gathered from on-site residences. This data was put into the IEUBK computer model, and a site-specific soil lead remediation goal of 510 ppm was calculated. This is the remediation goal presented in this Proposed Plan.

Organic-Contaminants in Soil

The two organic contaminants driving the risk in the soil at the Site are carcinogenic Polynuclear Aromatic Hydrocarbons (PAH's) and benzene.

Carcinogenic PAH's: Eight compounds, related in both their chemical structure and the health effects they may cause in humans, are considered carcinogenic PAHs. For simplicity in laboratory reporting, the concentrations of these carcinogenic PAH's are generally reported as one of the more common PAHs, benzo(a)pyrene (BAP). This comparative measurement is referred to as a BAP equivalent. The conversion to BAP equivalents is done using mathematical conversion factors which compare the toxicity of each compound to that of BAP. The EPA has determined that PAH concentration levels (measured in BAP equivalents) in soil that correspond to a 1×10^{-6} risk level, the NCP point of departure (point of departure is explained further in the Toxicity Assessment section of this Proposed Plan), would be below the practical quantitation limit. The practical quantitation limit is the lowest concentration of a contaminant that can be accurately measured. Accordingly, due to this technical limitation, EPA selected the lowest BAP equivalent level that could be accurately measured, 1 ppm BAP equivalent, as the remediation goal for PAHs in soil. This PAH remediation goal corresponds to a 1×10^{-5} excess lifetime cancer risk.

Benzene: A remediation goal of 1 ppm benzene was selected for benzene in soil, and this remediation goal corresponds to a 1×10^{-6} excess lifetime cancer risk--the NCP point of departure.

Additional Organic Contaminants: Due to the limited sampling undertaken for organic contaminants at the Site and due to the oily nature of the matrix of the soil contamination (this matrix could mask contaminants when a standard laboratory analysis is performed), a remediation goal has also been set for certain site-related contaminants even though the Baseline Risk Assessment did not identify these certain contaminants as posing an

unacceptable human health risk in soil. For all Site-related compounds discovered during the excavation or sampling performed as part of the Remedial Action, maximum concentrations left unexcavated will be those which correspond to an excess lifetime cancer risk of 1×10^{-6} or less, calculated assuming the type of residential exposure that is consistent with the Site Baseline Risk Assessment. For non-carcinogenic compounds, maximum concentrations left unexcavated will be those that correspond to an HI less than or equal to 1.

Benzene in Indoor Air

The EPA found that the indoor air concentration of benzene that corresponds to an excess lifetime cancer risk of 1×10^{-6} is actually below the non-site-related background concentration of benzene in ambient outdoor air. Accordingly, EPA adjusted the remediation goal upward to take into account this background concentration. A goal of 3 ppbv was selected, which is the high end value of the background concentration range. This remediation goal corresponds to an excess lifetime cancer risk of 1×10^{-5} .

LNAPL Removal

The purpose of the extraction of LNAPL is to keep it from continuing to act as a source of contamination for indoor air, soil, and ground water. Due to the nature of the extraction methods for LNAPL plumes, it is more appropriate to establish a performance standard for LNAPL extraction than it is to select a remediation goal. Therefore, this Proposed Plan requires LNAPL to be extracted until a maximum of one-tenth of a foot (0.1 foot) of LNAPL remains in the monitoring wells (s) or extraction well(s) completed in the LNAPL plume. The LNAPL thickness will be measured using an interface probe. That is, once the LNAPL thickness in the monitoring or extraction wells for each plume has stabilized at 0.1 foot or less the LNAPL removal may stop. Whether or not the plume has stabilized will be determined by statistically analyzing data from four equally-spaced sampling events, conducted over a minimum of a one-year period. This standard is based on EPA guidance and common engineering practice during hydrocarbon recovery operations at underground storage tank locations (EPA, September 1996).

SECTION 6

Summary of Remedial Alternatives

This section summarizes the five non-intrusive remedial alternatives developed during the FS. These alternatives are analyzed in more detail in the FS, which is part of the administrative record file.

- **Alternative 1:** *No Action*
- **Alternative 2:** *Implementation of the Common Elements:* Sampling for Lead in Surface Soil and Sampling for Hydrocarbons in Surface and Subsurface Soils at the Request of On-site Community Members; Cleanup of Lead-Contaminated Surface Soil and Hydrocarbon-Contaminated Surface and Subsurface Soil Discovered during Requested Sampling or Uncovered during Earthmoving Activities; Sampling for Benzene in Indoor Air at the Request of On-site Community Members; Mitigation of Indoor Air Contamination Discovered through Requested Sampling; Periodic Notification of the On-site Community of Potential Contamination and of Available Services; Ground Water Use Restrictions; and Environmental Monitoring of LNAPL, Ground Water, and Indoor Air
- **Alternative 3:** *Implementation of the Common Elements Plus LNAPL Removal Through Skimming (Plume A, B, C)*
- **Alternative 4:** *Implementation of the Common Elements Plus LNAPL Removal Through Dual Phase Extraction (Plume A, B, C)*
- **Alternative 5: The Preferred Alternative;** *Implementation of the Common Elements Plus LNAPL Removal Through Dual Phase Extraction (Plume A, B, C and Zone 1)*

The EPA will select the final remedial alternative based on the administrative record file and based on comments received during the public comment period.

Common Elements of Remedial Alternatives 2, 3, 4, and 5

Common Elements—Feasibility Study Assumptions

Each of the remedial alternatives (other than Alternative 1) evaluated as part of the detailed analysis have certain assumptions and aspects in common. These are called the common elements. Common elements which concern assumptions used in the FS for Alternatives 2, 3, 4, and 5 follow:

- All costs were based on a 30-year project lifetime.
- All costs have a degree of accuracy of +50% to -30% pursuant to the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA - Interim Final" OSWER Directive 9355.301 (October 1988) insofar as it is consistent with the NCP.
- All costs and implementation times are estimates which should be used as a basis for a comparative analysis of the alternatives only, and not as a determination of absolute costs which will be expended during the project. These costs will be recalculated in the Remedial Design Work Plan.
- Any changes to the common elements, since publication of the cost estimates in the FS, that could result in a change in cost for one alternative, will result in a proportional change in cost to all alternatives; consequently, the comparisons between the alternatives remain valid.
- Present worth costs are presented in this Proposed Plan so that the remedial action alternatives which may have costs that are incurred in different time periods can be compared on the basis of a single cost figure for each alternative. Also, although some alternatives may take over 30 years to implement, a maximum cost period of 30 years is used for comparison purposes. For example, Alternative 3, which would implement skimming of LNAPL, has its cost estimated over a 30-year period, although it would probably take much longer to implement. Present worth or present value cost is the amount of money that would have to be set aside at the inception of the response action in order to assure that funds will be available in the future to complete a given response action, assuming certain economic factors such as an interest rate and an inflation rate.
- Under the NCP, if a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the Site at concentrations that are above concentrations that allow for unlimited use and unrestricted exposure, EPA must review the remedial action every five years. Although the performance of five-year reviews is not itself part of a remedial alternative, upon implementation of any of the proposed remedial alternatives, EPA would perform five-year reviews. The five-year reviews are necessary because each remedial alternative evaluated allows hazardous substances to remain on-site in concentrations that restrict use after the Remedial Action. EPA must conduct the reviews no less often than every five years after initiation of the Remedial Action in order to ensure that human health and the environment are being protected. (See 42 U.S.C. Section 9621(c).)
- All alternatives will meet ARARs except for ground water ARARs. Through this Proposed Plan, EPA proposes to seek a Technical Impracticability Waiver of ground water ARARs due to the engineering difficulties anticipated in achieving ground water

restoration in the hydrogeologic environment beneath the Site (see Section 4 of this Proposed Plan, Principal and Low-Level Threat Wastes).

- All alternatives will support the current and future anticipated land use at the Site -- residential, commercial, and light industrial.

Common Elements—Technical Features

In addition to their common assumptions, each of the remedial alternatives (other than Alternative 1) evaluated as part of the detailed analysis also share certain technical common elements regarding the manner in which they address lead-contaminated soils, hydrocarbon-contaminated soils, indoor air contaminated with COCs, ground water, and environmental monitoring.

Alternatives 2, 3, 4, and 5, all of which deal with soil contamination, have been revised slightly from those developed in the FS. In this Proposed Plan, these alternatives now include more extensive sampling for more Site-related chemicals at the request of on-site community members. This revision was based on input from residents, local realtors, and members of the Bossier City Chamber of Commerce, all of whom had concerns about EPA's ability to assure property owners that their respective property is not contaminated with Site-related chemicals if EPA only tested for lead or only for organics. Without sampling for all known Site contaminants found to present an unacceptable health risk (such as lead, benzene, and carcinogenic PAHs), EPA would be unable to provide such assurances.

Many of these common elements employ the services of a contractor to perform excavation, sampling, and notification activities. This local contractor is referred to as "LDEQ's agent," because, under the proposed alternative, LDEQ would be performing direct oversight of the contractor. The LDEQ would also handle local coordination of the cleanup and communication with EPA regarding Site activities. This is an arrangement commonly used during site cleanups so that the cleanups may proceed quickly. The EPA would retain overall project management responsibility at the Site, and the EPA would ensure that the PRP funds the cleanup.

The technical elements common to Alternatives 2, 3, 4, and 5 are summarized below:

Sampling and Cleanup of Lead-Contaminated Surface Soil

Any parties conducting earthmoving activity (e.g, tree planting, vegetable gardening, irrigation, underground utility installation and/or repair) would be able to contact LDEQ's agent to obtain soil sampling and analysis. Whenever concentrations of lead are found to exceed 510 ppm in surface soil, the LDEQ, or its agent, will oversee the excavation and

off-site disposal of the lead-contaminated soil and the backfilling of the area in question with clean soil. Soil excavation will continue until lead concentrations meet the remediation goal, or until 2 feet bgs is reached (whichever is sooner). If the excavation in question reaches that lead remediation goal before 2 feet bgs, then the final confirmatory sampling for lead in each excavation will also include sampling for organic contaminants. If organic contaminants are discovered at concentrations which exceed the remediation goals, the excavation will continue as described in the following section concerning cleanup of hydrocarbon-contaminated soil.

Sampling and Cleanup of Organic-Contaminated Surface and Subsurface Soil

Any parties conducting earthmoving activity (e.g., tree planting, vegetable gardening, irrigation, underground utility installation and/or repair) would be able to contact LDEQ's agent to obtain soil sampling and analysis whenever the earthmoving activity unearths stained or malodorous surface or subsurface soil. In addition, any parties that suspect hydrocarbon-contamination on their property due to staining, malodorous soil, or indoor air contamination may contact LDEQ's agent to obtain soil sampling and analysis.

Whenever concentrations of benzo(a) pyrene equivalents (BAPEQ) or of benzene exceed 1 ppm in surface or subsurface soil, LDEQ, or its agent, will oversee the excavation and off-site disposal of the hydrocarbon-contaminated soil and backfilling of the area in question with clean soil. Excavation will continue until hydrocarbon concentrations meet remediation goals.

LDEQ's agent will sample soil for lead contamination in excavations intended to address hydrocarbon-contaminated material whenever those excavations meet organic remediation goals before they reach 2 feet bgs. Whenever concentrations of lead are found to exceed 510 ppm in these surface soil excavations, the LDEQ, or its agent, will oversee the excavation and off-site disposal of the lead-contaminated soil and the backfilling of the area in question with clean soil. Soil excavation will continue until lead concentrations meet the remediation goal, or until 2 feet bgs is reached (whichever is sooner).

Indoor Air Sampling and Mitigation of Indoor Air Contamination

The indoor air remedial action (e.g., sampling, venting, sealing) will be administered by LDEQ or its agent. A system will be established to facilitate communication between Site residents and workers and LDEQ. The LDEQ will be notified whenever a Site resident or worker desires indoor air testing for an on-site residence or workplace. When LDEQ, or its agent, is contacted, it will obtain access, sample the indoor air, take remedial action (e.g., venting, sealing, etc.) as appropriate, and substantiate the effectiveness of the remedial action by follow-up sampling.

Ground Water Use Restrictions

The EPA and the LDEQ will work with Bossier City officials to implement institutional controls (through a city ordinance) to ban the use of Site ground water, and to thereby eliminate the potential for human exposure to COCs in ground water. Institutional controls implemented by the City will include prohibition of new water supply wells in the general area of the Site and prohibition of the use of ground water taken from the vicinity of the Site.

Notification of the On-Site Community

In order to communicate information about the availability of soil and indoor air sampling, and soil excavation services to the property owners or lessees, property managers, business owners, public agencies, and utility companies, LDEQ's agent will send quarterly notices to those parties through utility bills or direct mailings.

In order to communicate information about the ground water restrictions to property owners or lessees, property managers, business owners, and public agencies, the LDEQ agent will also send quarterly notices to those parties through utility bills or direct mailings.

Quarterly notifications will continue until a five-year review of the remedy is performed at which time the frequency of notification will be evaluated and changed if warranted. Notification will not be completely discontinued until an EPA five-year review of the remedy reveals that no hazardous substances, pollutants, or contaminants remain in soil, ground water, or indoor air at the Site at concentrations that allow for unlimited use and unrestricted exposure.

Environmental Monitoring

Because hazardous substances will remain on the Site, environmental monitoring of LNAPL, ground water, and indoor air will be performed to evaluate remedy impacts and effectiveness. Environmental monitoring will include:

- Quarterly LNAPL monitoring to evaluate changes in LNAPL volume over time, and to estimate the effectiveness of the LNAPL removal remedy in order to ensure that LNAPL is being removed in a manner that will meet the performance standard.
- Ground water monitoring to track the location of the dissolved-phase contaminants of concern. Ground water monitoring will include ground water sampling and water level measurements in order to track the direction and rate of contaminant plume migration. Ground water monitoring will be performed semiannually (twice per year) using as many monitoring wells as may be necessary to adequately characterize and monitor the plumes and their migration.

- Indoor air sampling will be performed to ensure the effectiveness of corrective measures applied to dwellings. The LDEQ or its agent will perform semiannual (twice per year) air sampling for indoor air COCs at locations where indoor air mitigation measures have been implemented in order to ensure long-term effectiveness of indoor air corrective measures.

Alternative 1 - No Further Action Alternative

No Further Action, Operation and Maintenance

Alternative 1 is the baseline condition against which other remedial alternatives are compared, as required by the NCP and SARA. Alternative 1 would provide no further remedial action at the Site. Alternative 1 would not address the human health risks identified in Section 4 of this document and, therefore, does not protect human health. Alternative 1 does not reduce contaminant toxicity, mobility, or volume and it is not an effective or permanent remedy. Since, under all alternatives including the no further action alternative, hazardous substances would remain on the Site, CERCLA requires EPA to conduct a review of the Remedial Action every five years in order to assess whether human health and the environment are being protected. Alternative 1 is mentioned throughout the evaluation process for the purposes of comparison.

- Capital cost: \$0
Annual operation and maintenance (O&M): \$3,700
Present worth: \$46,100
Implementation time: Not applicable
Total cost: \$111,400

Alternative 2 - Implementation of Common Elements

Sampling for Lead in Surface Soil and Sampling for Hydrocarbons in Surface and Subsurface Soils at Request of On-site Community Members; Cleanup of Lead or Hydrocarbon-Contaminated Surface and Subsurface Soil Discovered during Requested Sampling or Uncovered during Earthmoving Activities; Sampling for Benzene in Indoor Air at the Request of On-site Community Members; Mitigation of Indoor Air Contamination Discovered through Requested Sampling; Periodic Notification of the On-site Community of Potential Contamination and of Available Services; Ground Water Use Restrictions; and Environmental Monitoring of LNAPL, Ground Water, and Indoor Air

- Capital cost: \$9.9 million
 Annual O&M: \$146,000
 Present worth: \$11.7 million
 Construction time: 1 year (indoor air mitigation completed in this time period)
 Total cost: \$14,126,600

Alternative 2 calls for implementation of all of the common elements described in the Common Elements section. Alternative 2 does not offer any unique elements for LNAPL recovery, but does provide for the following: mitigation of COC contamination in indoor air; surface soil remediation in areas impacted by lead contamination; and surface and subsurface soil remediation in areas impacted by hydrocarbon-contamination where hydrocarbon-contaminated soils are found during on-site earthmoving activities or sampling; a ban on ground water use to prevent human exposure; and environmental monitoring. Although the sampling, excavation, and mitigation methods were cost-estimated over a 30-year period, the actual time the common elements would remain in effect could be longer.

The present value of each of the common elements (rounded to the nearest \$100) associated with Alternative 2 and successive remedial alternatives are as follows:

Lead-Contaminated Soil Removal in Residential Areas	\$2,713,800
Hydrocarbon-Contaminated Soil Removal in Residential Areas	\$3,009,600
Indoor Air Remediation	\$4,771,200
Ground water Use Ban	\$90,000
Environmental Monitoring	\$2,763,200
Five-Year Reviews	\$106,100
Total Cost - Common Elements	\$13,453,900
Total Present Value of Common Elements	\$11,689,800

Alternative 3 - Implementation of Common Elements plus LNAPL Recovery by Skimming (Plumes A, B, C)

Sampling for Lead in Surface Soil and Sampling for Hydrocarbons in Surface and Subsurface Soils at the Request of On-site Community Members; Cleanup of Lead or Hydrocarbon-Contaminated Surface and Subsurface Soil Discovered during Requested Sampling or Uncovered during Earthmoving Activities; Sampling for Benzene in Indoor Air at the Request of On-site Community Members; Mitigation of Indoor Air Contamination Discovered through Requested Sampling; Periodic Notification of the On-

site Community of Potential Contamination and of Available Services; Ground Water Use Restrictions; and Environmental Monitoring of LNAPL, Ground Water, and Indoor Air; LNAPL Recovery by Skimming (Plumes A, B, C) and LNAPL Recycling/Reuse or Disposal

- Capital Cost: \$10.7 million
Annual O&M: \$326,000
Present Worth: \$14.7 million
Construction Time: 1 year (indoor air mitigation completed and LNAPL skimming system installed)
Additional Time Assumption: recovery by skimming will take more than 30 years (in the range of 100 years)
Total Cost: \$20,206,500

Alternative 3 calls for the following: source removal through LNAPL recovery using skimming in Plumes A, B and C; LNAPL management through recycling/reuse or disposal; and management of other media as described in Alternative 2 and in the Common Elements of Remedial Alternatives 2, 3, 4, and 5 Section of this Proposed Plan. Alternative 3 and all of the alternatives which include LNAPL removal will remove at least 325,000 gallons of LNAPL.

Skimming is a process which involves the slow removal of LNAPL through the use of extraction wells. Two types of skimming equipment are available: mechanical skimming equipment which actively extracts LNAPL; and passive skimming equipment which accumulates the LNAPL over time. Skimming operations would be constructed in a safe manner that prevents trespassers from coming into contact with the LNAPL or the equipment. LNAPL would be removed until a threshold thickness of 0.1 foot of LNAPL, measured using an interface probe in monitoring or extraction wells was achieved. This performance standard would be met when the threshold thickness had stabilized at 0.1 foot over four equally-spaced sampling events, conducted over a minimum of a one-year period.

Alternative 3 provides protection to human health through source reduction accomplished by LNAPL recovery. That is, removal of the LNAPL will eliminate the principal source of benzene and other hazardous hydrocarbons which pollute indoor air on the Site. CERCLA favors the reuse of recovered waste materials, which may be accomplished by LNAPL recycling. Due to the slow rate of LNAPL source removal through skimming, Alternative 3 will reduce the threat to indoor air very slowly. In areas contaminated with low thicknesses of LNAPL (such as Zone 1), skimming would be extremely slow. Skimming would not address the residual LNAPL held in soil because it is relatively passive, and does nothing to draw the LNAPL out of the interstitial area between soil particles. Alternative 3 does not address the thin layer of LNAPL in Zone 1 because of the extensive length of time that it would take for any LNAPL to accumulate in a skimming well in this zone.

Sampling for Lead in Surface Soil and Sampling for Hydrocarbons in Surface and Subsurface Soils at the Request of On-site Community Members; Cleanup of Lead or Hydrocarbon-Contaminated Surface and Subsurface Soil Discovered during Requested Sampling or Uncovered during Earthmoving Activities; Sampling for Benzene in Indoor Air at the Request of On-site Community Members; Mitigation of Indoor Air Contamination Discovered through Requested Sampling; Periodic Notification of the On-site Community of Potential Contamination and of Available Services; Ground Water Use Restrictions; and Environmental Monitoring of LNAPL, Ground Water, and Indoor Air; Enhanced LNAPL Recovery by Dual Phase Extraction (Plumes A, B, C); LNAPL Recycling/Reuse or Disposal; and Treatment or Disposal of Co-extracted Ground Water and Vapors

- Alternative 4, calls for the following: source removal through LNAPL recovery using dual phase extraction on Plumes A, B and C; LNAPL management through recycling/reuse or disposal; treatment of co-extracted ground water and vapor using granular activated carbon (GAC), if co-extracted ground water and vapor do not meet treatment and performance standards; discharge of treated co-extracted ground water to the publicly-owned treatment works (POTW); and management of other media as described in the Common Elements of Remedial Alternatives 2, 3, 4, and 5 Section of this Proposed Plan.

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using the Best Demonstrated Available Technology (BDAT) which is the performance standard.

Dual phase extraction is an enhanced LNAPL recovery technique, and, thus, would recover more LNAPL in a shorter time frame than Alternative 3 which employs skimming. Dual phase extraction operations would be constructed in a safe manner that prevents trespassers from coming into contact with the LNAPL or the equipment.

Alternative 4 provides protection to human health by removing source material in the form of LNAPL which is the principal source of indoor air contamination; moreover, Alternative 4 removes the LNAPL more quickly than Alternative 3. The duration of LNAPL impact on indoor air and ground water under Alternative 4 will be shorter than it would be under Alternative 3 because Alternative 4 uses a more aggressive LNAPL recovery technique. CERCLA favors the reuse of recovered waste materials, which may be accomplished through LNAPL recycling under Alternative 4.

Alternative 5 - The Preferred Alternative: Implementation of Common Elements plus Enhanced LNAPL Recovery By Dual Phase Extraction (Plumes A, B, C, and Zone 1)

Sampling for Lead in Surface Soil and Sampling for Hydrocarbons in Surface and Subsurface Soils at the Request of On-site Community Members; Cleanup of Lead or Hydrocarbon-Contaminated Surface and Subsurface Soil Discovered during Requested Sampling or Uncovered during Earthmoving Activities; Sampling for Benzene in Indoor Air at the Request of On-site Community Members; Mitigation of Indoor Air Contamination Discovered through Requested Sampling; Periodic Notification of the On-site Community of Potential Contamination and of Available Services; Ground Water Use Restrictions; and Environmental Monitoring of LNAPL, Ground Water, and Indoor Air, Enhanced LNAPL Recovery by Dual Phase Extraction (Plumes A, B, C, and Zone 1); LNAPL Recycling/Reuse or Disposal; and Treatment or Disposal of Co-Extracted Ground Water and Vapors

- Capital Cost: \$11.3 million
Annual O&M: \$428,000
Present Worth: \$14.8 million
Construction Time: 1 year (indoor air mitigation completed)
2 years (dual phase extraction system installed)
Additional Time Assumption: recovery by dual phase extraction will take 8 years
Total Cost: \$17,757,200

Alternative 5 calls for the following: source removal through LNAPL recovery using dual phase extraction on Plumes A, B and C and Zone 1; LNAPL management through recycling/reuse or disposal; treatment of co-extracted ground water and vapor using granular activated carbon (GAC), if co-extracted ground water and vapor do not meet treatment and performance standards; discharge of treated co-extracted ground water to the publicly-owned treatment works (POTW); and management of other media as described in the Common Elements of Remedial Alternatives 2, 3, 4, and 5 Section of this Proposed Plan. (See description of dual phase extraction in Alternative 4.) Dual phase extraction operations would be constructed in a safe manner that prevents trespassers from coming into contact with the LNAPL or the equipment.

As in Alternative 4, ground water that is incidentally extracted during LNAPL removal as part of any of the remedial alternatives that address LNAPL, would be treated and discharged to a POTW. Co-extracted ground water would be treated, under each of the alternatives that address LNAPL, to meet the POTW treatment standards. Co-extracted vapor would be treated using the Best Demonstrated Available Technology (BDAT) which is the performance standard.

Alternative 5 provides the most protection to human health of all of the five non-invasive remedies presented in this Proposed Plan by removing LNAPL and residual LNAPL which is the principal source of indoor air contamination, in the fastest manner over the broadest Site area. Alternative 5 removes source material (LNAPL) from all identified LNAPL plumes in addition to removing source material (LNAPL) from any plume that underlies Indoor Air Quality Impairment Zone 1 (Figure 4). Removing the LNAPL from plumes which underlie areas of indoor air contamination will remove the principal source of indoor air contamination. Indoor air contamination may be caused by COCs volatilizing from LNAPL or by COCs volatilizing from buried hydrocarbon-contaminated wastes. Since soil gas can travel either vertically or horizontally, depending on the subsurface material which it encounters, it is not necessary for LNAPL or buried hydrocarbon waste to directly underlie an indoor area for that area to be contaminated by soil gas from the LNAPL or hydrocarbon waste. Based on the community's request for a non-invasive remedy, this Proposed Plan does not address hydrocarbon waste that lies beneath Site structures.

Alternative 5 shortens the duration of indoor air and ground water impact by using the most aggressive LNAPL recovery program over the largest area of the Site. Contaminant migration and LNAPL volume in the aquifer will be reduced most effectively and most rapidly using dual phase extraction. CERCLA favors the reuse of recovered waste materials, which may be accomplished through LNAPL recycling under Alternative 5.

SECTION 7

Comparative Analysis of Alternatives

The EPA uses nine criteria to evaluate remedial alternatives for the cleanup of a release. These nine criteria are categorized into three groups: threshold, balancing, and modifying. The threshold criteria must be met in order for an alternative to be eligible for selection. The threshold criteria are overall protection of human health and the environment and compliance with ARARs. The balancing criteria are used to weigh major tradeoffs among alternatives. The five balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost.

The modifying criteria are state acceptance and community acceptance, which are evaluated once the Proposed Plan public comment period is complete.

Based on the information and the analysis presented in the FS and this Proposed Plan, EPA has identified Alternative 5 as its preferred alternative for the remediation of the release of hazardous substances at the Site. The EPA may modify its position regarding Site remediation based upon its assessment of community acceptance and state acceptance, the final two criteria, which will be described in the ROD after comments are received.

In the following analysis, the five remedial alternatives are evaluated in relation to each other with regard to the threshold and balancing criteria in order to identify the relative advantages and disadvantages of each alternative.

Overall Protectiveness of Human Health and the Environment

Alternative 1 (the No Action Alternative) fails to protect human health because it does not address the risks to human health that were identified in the Baseline Risk Assessment. If considerations are made to take into account the reductions in risk that were the result of the removal actions, Alternative 1 still fails to address all the risks remaining at the Site after the removal actions. Alternative 1 does nothing to protect the environment at the Site. Since Alternative 1 fails to protect human health, it is not eligible for selection under the NCP.

Alternative 2 (Implementation of the Common Elements) does not directly address the LNAPL that is the primary source of indoor air contamination on the Site; however it does address the other media (e.g., soil, indoor, ground water) through which contamination at the Site presents a risk. Alternative 2 relies on the natural degradation of the LNAPL. Accordingly, it is not as protective of human health as the other alternatives.

Alternatives 2, 3, 4, and 5 all address risks posed by contact with soil that is contaminated with lead or hydrocarbons. Alternatives 3, 4, and 5 each call for excavation of the contaminated soil and offsite disposal. In areas where hydrocarbon materials are excavated, Alternatives 2, 3, 4, and 5 provide additional protectiveness because the hydrocarbon material is a potential source of indoor air contamination. Excavation of buried hydrocarbon waste eliminates the potential for the COCs in the waste to volatilize. The excavation portion of Alternatives 2, 3, 4, and 5 is protective of human health.

Alternative 3 addresses the LNAPL through skimming and, therefore, it is protective of human health with respect to LNAPL. Alternative 3, however, takes so long to address the LNAPL, the primary source of indoor air contamination, that, of all the alternatives evaluated, it cannot be considered the most protective of human health. Moreover, Alternative 3 cannot recover residual LNAPL trapped in soil, another source of indoor air pollution. Since the LNAPL trapped in soil by capillary tension can become a source of indoor air contamination, Alternative 3 is not the most protective of human health of the alternatives; therefore, Alternative 3 was not selected.

Alternative 4, which uses dual phase extraction, a relatively fast form of LNAPL recovery, is protective of human health in the parts of the Site that it addresses, but it does not address all parts of the Site. Specifically, Alternative 4 does not address the LNAPL that underlies Zone 1; consequently, any LNAPL that underlies Zone 1 may remain a source of indoor air contamination in Zone 1 if Alternative 4 is selected.

Alternative 5, which also uses dual phase extraction, is the most protective of human health throughout the Site because it addresses the LNAPL contamination over the largest Site area. Moreover, Alternative 5 (and Alternative 4) will remove LNAPL trapped in soil by capillary tension.

Compliance with ARAR's

All of the Remedial Alternatives analyzed in this report would meet ARARs except for ground water ARARs. The EPA proposes that these ground water ARARs be waived pursuant to 40 CFR § 300.430 (f)(1)(ii)(C)(3) based on technical impracticability. The technical impracticability will be further explained in the Site ROD. Compliance with ARARs includes a review of chemical-specific, action-specific, and location-specific ARARs as discussed in the FS.

Ground water that is incidentally extracted during LNAPL removal (co-extracted ground water) as part of any of the remedial alternatives that address LNAPL, would be treated and discharged to a POTW. Co-extracted ground water would be treated, under each of the alternatives that address LNAPL, to meet the POTW standards.

Long-Term Effectiveness and Permanence

Alternative 1 (the No Action Alternative) will not be effective or permanent. Alternative 2 (Implementation of the Common Elements) does not address LNAPL source removal and is, therefore, not an effective or permanent long-term remedy. Alternatives 3, 4 and 5 offer the highest degree of long-term effectiveness and permanence because these alternatives offer the best source removal through a combination of soil excavation actions and LNAPL recovery. Of these alternatives, Alternative 5 offers the greatest potential for long-term effectiveness due to its use of aggressive dual phase LNAPL recovery over the largest contaminated area (i.e., LNAPL Plumes A, B and C, and any LNAPL that underlies Zone 1). Under Alternative 4, LNAPL recovery is less complete; consequently, indoor air contamination problems may continue to arise in Zone 1 if Alternative 4 is selected. Under Alternative 3, the less aggressive LNAPL recovery program (i.e., skimming) will take up to 100 years to become effective compared to 5 to 8 years for Alternatives 4 and 5 which each use dual phase extraction; therefore, Alternative 3 is the least acceptable of the three alternatives that offer the greatest degree of long-term effectiveness and permanence.

Reduction of Toxicity, Mobility or Volume through Treatment

Alternative 2 (Implementation of the Common Elements) would not call for the on-site treatment of any hazardous substance, so Alternative 2 does not meet the NCP criterion regarding reduction of toxicity, mobility, or volume through treatment for any on-site remedial operation. Under Alternative 2, benzene- and PAH-contaminated Soil that is excavated would be shipped to an off-site TSD where it may be incinerated. If it is incinerated, the mobility and toxicity of the benzene and PAH would be eliminated and the volume would be significantly reduced through treatment. No other treatment is contemplated under Alternative 2.

All the LNAPL cleanup alternatives (i.e., Alternatives 3, 4 and 5) will have the same treatment components of the common elements that are a part of Alternative 2. In addition, under the LNAPL cleanup alternatives, the LNAPL which underlies the Site will be recovered either by dual phase extraction or by skimming, both of which are a form of treatment. Ultimately, under each of the LNAPL cleanup alternatives, the LNAPL will be shipped off-site to a recycling/reuse operation or to a RCRA-compliant TSD. If the LNAPL goes to a TSD, it may be incinerated which will significantly reduce toxicity, mobility and volume. In addition, co-extracted ground water produced under Alternatives 4 and 5, the dual phase extraction alternatives, will be treated, if necessary to meet POTW standards using GAC. Co-extracted vapor produced under Alternatives 4 and 5, the dual phase extraction alternatives, will be treated using BDAT. Since Alternative 5 addresses

what is potentially the largest volume of LNAPL, Alternative 5 would use treatment to do the most to reduce the toxicity, mobility and volume of the LNAPL and the co-extracted ground water and vapor.

Short-Term Effectiveness

The LNAPL cleanup alternatives (i.e., alternatives 3, 4, and 5) share the common elements which make up Alternative 2, Implementation of the Common Elements. With respect to the NCP criterion "Short Term Effectiveness," except for problems associated with Alternative 2's failure to address LNAPL, the LNAPL cleanup alternatives and Alternative 2 will face similar short-term problems such as potential risks to the Site residents during implementation of soil excavation activities in residential areas. These potential risks are all manageable through use of engineering controls (e.g., water sprayed to control dust). Alternative 2 would not achieve protection until the LNAPL decomposed naturally (an unacceptably long period of time); accordingly, it is not protective in the short term. Moreover, since Alternative 2 would take so long to achieve protectiveness with respect to the LNAPL, it cannot be considered to provide long-term effectiveness.

Alternative 3 will also take a long time to become protective in areas above LNAPL plumes that it addresses, and Alternative 4 will take a long time to become protective in Zone 1. Only Alternative 5 attains Site-wide protectiveness in an acceptable period of time. Risks to human health and the environment that may be posed by the LNAPL cleanup alternatives are manageable as evidenced by the fact that GSHI has performed the skimming well operations at the Site without incident.

Implementability

Technical Feasibility

All of the common elements which would be used under Alternatives 2, 3, 4, and 5 are technically feasible. Specifically, within the common elements, the excavation components are time-proven techniques, the indoor air mitigation measures have been used at the Site with success, and institutional controls such as ground water restrictions have been thoroughly discussed with the City and LDEQ so no problems are anticipated. Environmental monitoring methods that would be used under Alternatives 2, 3, 4, and 5 are standard practice in the environmental industry.

Skimming, as proposed in Alternative 3, has been used at the Site for over one year. Dual phase extraction proposed in Alternatives 4 and 5 is a newer technology, and it has been proven in the field to recover greater amounts of LNAPL, including residual LNAPL, making it more successful than skimming.

Administrative Feasibility

The EPA and the PRP have been coordinating with the City and the State for many years regarding the elements of these various remedial alternatives, and no administrative difficulties are anticipated.

Availability of Equipment and Services

Alternative 1 (the No Action Alternative) has no implementability concerns as it represents the baseline condition. Equipment and workers necessary to implement Alternatives 2, 3, 4, and 5 are readily available. Recyclers and disposal firms are available in the area.

Cost

Cost estimates provided for all alternatives are limited to a 30-year time period in accordance with EPA guidance, even though actual implementation time frames may extend beyond the 30-year cost estimating period for the Common Element portions of all the alternatives and for the LNAPL recovery through skimming provided under Alternative 3.

Cost details, assumptions, and uncertainties related to each alternative are included as Appendix A of the FS. The FS uses the terminology Long Term Remedial Action (LTRA) costs in place of Operation and Maintenance (O&M) costs. For the purpose of this Proposed Plan, the terms are interchangeable.

Total Cost and O&M Cost

Alternative 1 (the No Action Alternative) is the lowest cost alternative, incurring costs only for the five-year reviews required under the CERCLA. Alternative 2 (Implementation of the Common Elements) is the next lowest in total cost, but it does not meet all of the RAOs related to LNAPL because it does not involve any engineered source control measures to address LNAPL. Alternative 3 has the highest total cost and the highest O&M cost of all of the remaining three engineered alternatives, but it is less protective in the long-term and in the short-term than Alternatives 4 and 5. Alternative 4 is the least expensive of the engineered alternatives in total cost and in O&M cost, but it does not provide for comprehensive LNAPL removal in all known source areas. Based on analysis

of total life-cycle costs, Alternative 5 offers the best overall protection of human health and the environment, and the shortest time to achieve compliance with RAOs and ARARs. Alternative 5 offers the most comprehensive LNAPL recovery in source areas of all alternatives evaluated in the FS.

Present Worth Costs

The present worth cost of Alternative 5 at \$14.8 million is only slightly greater than the present worth cost of Alternative 4 at \$14.4 million and the present worth cost of Alternative 3 at \$14.7 million, and it is only moderately more than the present worth cost of Alternative 2 at \$11.7 million. Alternative 5 offers by far the highest degree of protectiveness compared to all the other alternatives, much higher than its incremental cost. The reason that the present worth costs of Alternatives 4 and 5 are so close to the present worth cost of Alternative 3, which involves a much more simple technology, is that, under Alternatives 4 and 5 after eight years, the O&M costs are greatly reduced compared to the O&M costs of Alternative 3 which were cost-estimated over a 30-year period. Under Alternatives 4 and 5, O&M costs related to dual phase extraction of LNAPL are relatively high for the first eight years of the 30-year costing period, but the costs of alternatives 4 and 5 are much less than the cost of Alternative 3 after the first eight years.

State Acceptance

The EPA and the LDEQ have worked together in the investigation of the Site and in developing this Proposed Plan. The LDEQ documented its support for issuance of the Proposed Plan in an April 12, 2000, letter to the EPA.

SECTION 8

The Preferred Alternative

Alternative 5, Implementation of Common Elements coupled with Enhanced LNAPL Recovery By Dual Phase Extraction (Plumes A, B, C, and Zone 1), is EPA's preferred alternative. EPA recommends Alternative 5 because it will achieve substantial reduction of the risk posed by the principal threat wastes at the Site (i.e., the LNAPL) over the largest area of the Site, and because it provides a process for excavation of the other significant wastes at the Site.

In addition, Alternative 5 offers, relative to its costs, the best overall protection of human health and the environment and the shortest time to achieve compliance with RAOs. That is, the slight increase in the present worth cost of Alternative 5, compared to the present worth cost of Alternative 4 (or any other alternative) offers a large increase in effectiveness. Alternative 5 offers the most comprehensive LNAPL recovery in source areas of all the alternatives evaluated.

The preferred alternative, Alternative 5, meets the remedial action objectives in all of the affected media:

Soil: Alternative 5 would address significant low-level threat wastes in the soil medium through the establishment of a local capability to respond to future contaminated soil concerns. Alternative 5 would also remove and dispose of lead-contaminated surface soil and hydrocarbon-contaminated surface and subsurface soil that is discovered during requested sampling, or earth-moving activities. Disposal would occur in an appropriate offsite landfill, and excavated areas would be backfilled with clean soil.

Indoor Air: Alternative 5 would address the threat to human health from indoor air contamination through the establishment of a local capability to respond to future indoor air concerns. Alternative 5 would implement mitigation measures for indoor air contamination through actions such as foundation sealing and HVAC system modification if necessary. Also, Alternative 5 would use dual phase (liquid and vapor) extraction (a form of treatment) to remove the LNAPL, the primary source of the indoor air contamination. Alternative 5 calls for periodic environmental monitoring of indoor air to ensure the protectiveness of the remedy.

Ground Water: Alternative 5 would address the principal threat waste at the Site, LNAPL, which is a major source of the Site ground water contamination, through removal of the LNAPL from the subsurface using dual phase (liquid and vapor) extraction. Alternative 5 calls for periodic environmental monitoring of the ground water to ensure that it is not migrating to non-contaminated areas and periodic environmental monitoring of the LNAPL to evaluate whether the dual phase extraction system is recovering LNAPL as planned. Under EPA's proposed remedy, the threat to

human health posed by contaminated ground water at the Site will be addressed by preventing human exposure through institutional controls.

The proposed remedy may change in response to public or State comments or in response to new information. The final selected remedy will be documented in the ROD which will be issued after the public comment period for this Proposed Plan.

The main uncertainty associated with selection of the preferred alternative is the lack of comprehensive data in some areas of the Site. This uncertainty will be addressed during the implementation of Alternative 5.

Based on information currently available, EPA, the lead agency, believes that the preferred alternative meets the threshold criteria (40 CFR § 300.430(f)(1)(i)(A)) and provides the best balance of tradeoffs among the other alternatives with respect to the balancing criteria (40 CFR § 300.430(f)(1)(i)(B)). The EPA expects the preferred alternative to satisfy the statutory requirements of CERCLA section 121 (b), 42 U.S.C § 9621 (b), that is, the preferred alternative will:

- Be protective of human health and the environment;
- Comply with ARARs for all media, except for ground water where a waiver is justified;
- Be cost-effective; and
- Utilize permanent solutions and alternative treatment technologies or resource recovery technologies (such as recycling/reuse) to the maximum extent practicable.

This remedy, Alternative 5, satisfies the preference for treatment as a principal element for the LNAPL and for co-extracted ground water and vapor. For the soil contaminated with either lead, or with lead and hydrocarbons, the preference for treatment will not be satisfied because soil contaminated with lead, in general, is not amenable to treatment.